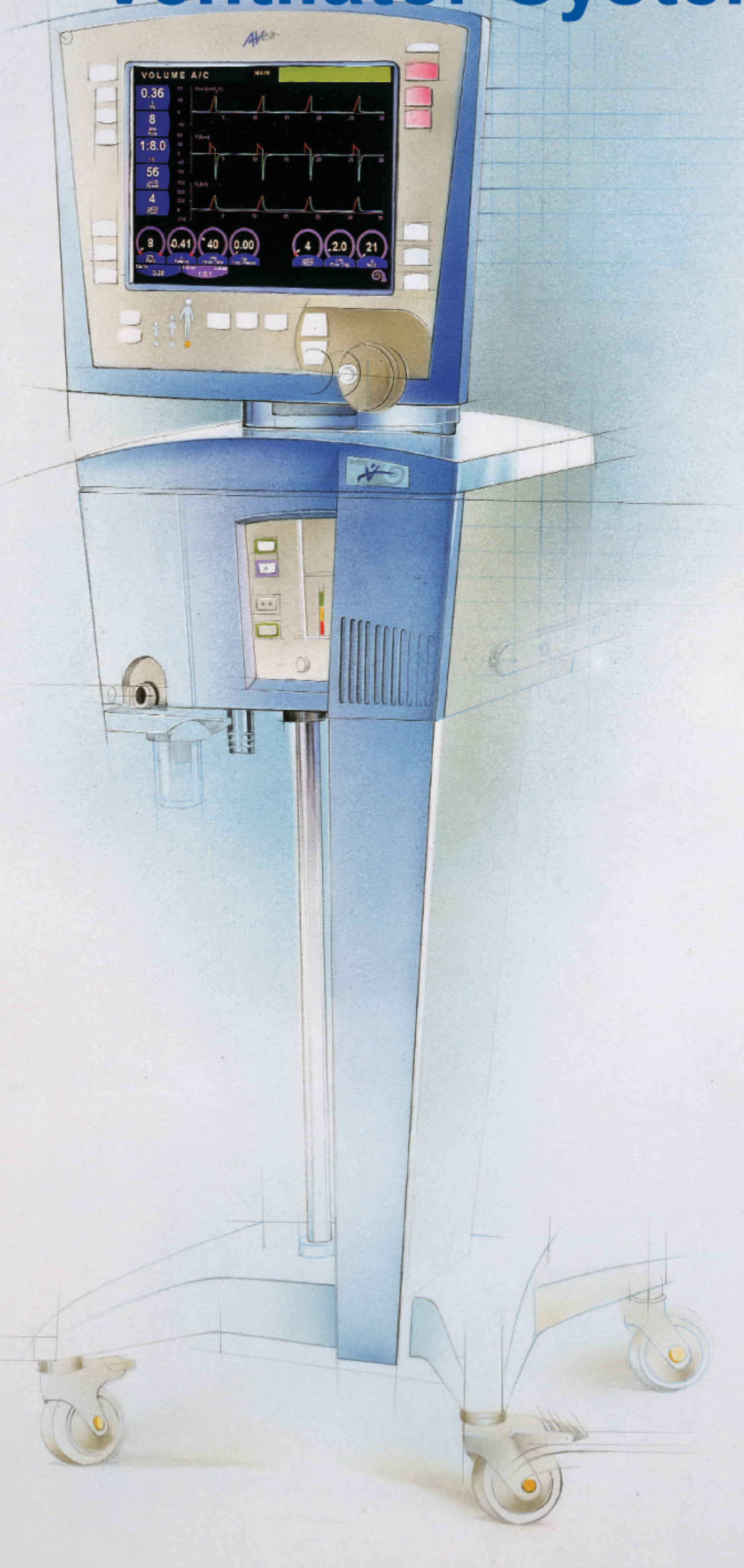
Service Manual
AVEA™ Ventilator System



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L1524 Rev. C

Service Manual

AVEA Ventilator Systems

L1524 Rev. C

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Revision History

Date	Revision	Pages	Changes
August 2002	Rev. A	All	Released Engineering Document Control ECO
July 2003	Rev. B	All	Add Exception button and Exception screen to Error Log screen. Add list of error codes. Add OVP kits & instructions. Add Software upgrade instructions. Add heliox Smart connector instructions. Add Compressor upgrade instructions. Add cart instructions (both). Add external battery pack instructions. Add Insp & Exp transducer Cal instructions. Add ref to Communications Protocol. Add unpacking & setup instructions. Reorganize chapters, add chapter 3, add chapter 5 (OVP), add software upgrade info (chapter 6), add chapter 9, add chapter 10, add appendix D.

January 2006	Rev. C	Throughout	Updated the company name.
		vi	Added external batteries to the Limitation of Liability.
		1-7	Added symbols for the battery and for HeOx.
		2-1	Updated the General Description.
		2-2	Changed the references of the Tracheal Catheter and the Esophageal Balloon.
		2-3	Changed “O_2 bottle” to “O_2 tank.”
		2-6	Changed the Monitor MCU description.
		2-9	Updated the description of the power supply system and the Transducer / Alarm PCB.
		2-12	Updated the description of the heated expiratory system.
		3-1	Updated the standard-stand carton contents table.
		3-8	Updated the procedure for setting up the Customer Transport Cart kit.
		3-11 – 3-12	Updated figures.
		3-14	Added part number references to “E Cylinder Bracket Assembly Instructions.”
		4-1	Added Pediatric Patient Circuit to the list of equipment.
		4-2	Removed the note regarding the UIM.
		4-3	Replaced the word “arm” with “neck.” Removed the note regarding the UIM.
		4-4	Added a note regarding the screws to the Metal Top Cover section.
		4-4 – 4-7	Updated the Gas Delivery Engine Removal procedure.
		4-11 – 4-12	Updated the fuse specifications.
		4-15 – 4-16	Updated the Compressor /Scroll Pump section.

		4-16	Changed the part number of the Enhanced Patient Monitor board.
		4-18 – 4-19	Added the fan assembly and power supply part numbers.
		4-22	Added part numbers to step 1 of the removal procedure.
		4-23	Changed step 5 of the Installation procedure to include the part number.
		5-1	Added references to PSI to the Setup procedure.
		5-4 – 5-7	Updated the Manual Alarms Testing section.
		5-10	Added two steps to the Testing Guidelines section.
		5-11	Added step 22 to the Membrane Switch test.
		5-12 – 513	Op. Verification Checklist
		5-16	Updated the Checkout Sheet.
		A-58	Replaced figure A-1
		A-59 – A-60	Updated the MIB Connection section.
		A-61	Added the Blender Bleed section.
		A-62	Added the Sound Levels section.
		A-63 – A-64	Updated the Water Trap section.
		A-66	Updated the Message Bar Text table.
		A-69 – A-74	Added the Monitor Ranges and Accuracies table.
		A-75	Added the Sensor Specifications and Circuit Resistance table.
		A-76	Added the Hot Wire Flow Sensor Specifications table.
		A-77	Added the Circuit Resistance section.

Notices

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EMC Notice

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions in this manual, electromagnetic interference may result. The equipment has been tested and found to comply with the limits set forth in EN60601-1-2 for Medical Products. These limits provide reasonable protection against electromagnetic interference when operated in the intended use environments described in this manual.

The ventilator has been tested to conform to the following specifications:

MIL-STD-461D:1993, MIL-STD-462D:1993, EN55011:1991, IEC 1000-4-2:1994, IEC 1000-4-3:1994, IEC 1000-4-4:1994, IEC 1000-4-5:1994, QUASI-STATIC:1993

This ventilator is also designed and manufactured to comply with the safety requirements of IEC 601-1, IEC 601-2-12, CAN/CSA-C22.2 No. 601.1-M90, and UL 2601-1.

MRI Notice

This equipment contains electromagnetic components whose operation can be affected by intense electromagnetic fields.

Do not operate the ventilator in an MRI environment or in the vicinity of high-frequency surgical diathermy equipment, defibrillators, or short-wave therapy equipment. Electromagnetic interference could disrupt the operation of the ventilator.

Intended Use Notice

The AVEA Ventilators are designed to provide ventilator support for the critical care management of infant, pediatric or adult patients with compromised lung function. They are intended to provide continuous respiratory support in an institutional health care environment. **They should only be operated by properly trained clinical personnel, under the direction of a physician.**

Regulatory Notice

Federal law restricts the sale of this device except by or on order of a physician.

IEC Classification

Type of Equipment: Medical Equipment, Class 1 type B

Adult/Pediatric/Infant Lung Ventilator

Declaration of Conformity Notice

This medical equipment complies with the Medical Device Directive, 93/42/EEC, and the following Technical Standards, to which Conformity is declared:

EN60601-1
EN60601-1-2
ISO 13485

EU Notified Body:

BSI (Reg. No. 0086)

Trade names:

AVEA Ventilator

CE

0086

If you have a question regarding the Declaration of Conformity for this product, please contact VIASYS Respiratory Care Inc. at the number given in Appendix A.

Warranty

THE AVEA® ventilator systems are warranted to be free from defects in material and workmanship and to meet the published specifications for TWO (2) years or 16,000 hours, whichever occurs first.

The liability of VIASYS Respiratory Care Inc., (referred to as the Company) under this warranty is limited to replacing, repairing or issuing credit, at the discretion of the Company, for parts that become defective or fail to meet published specifications during the warranty period; the Company will not be liable under this warranty unless (A) the Company is promptly notified in writing by Buyer upon discovery of defects or failure to meet published specifications; (B) the defective unit or part is returned to the Company, transportation charges prepaid by Buyer; (C) the defective unit or part is received by the Company for adjustment no later than four weeks following the last day of the warranty period; and (D) the Company's examination of such unit or part shall disclose, to its satisfaction, that such defects or failures have not been caused by misuse, neglect, improper installation, unauthorized repair, alteration or accident.

Any authorization of the Company for repair or alteration by the Buyer must be in writing to prevent voiding the warranty. In no event shall the Company be liable to the Buyer for loss of profits, loss of use, consequential damage or damages of any kind based upon a claim for breach of warranty, other than the purchase price of any defective product covered hereunder.

The Company warranties as herein and above set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of the rendering of technical advice or service by the Company or its agents in connection with the Buyer's order of the products furnished hereunder.

Limitation of Liabilities

This warranty does not cover normal maintenance such as cleaning, adjustment or lubrication and updating of equipment parts. This warranty shall be void and shall not apply if the equipment is used with accessories or parts not manufactured by the Company or authorized for use in writing by the Company or if the equipment is not maintained in accordance with the prescribed schedule of maintenance.

The warranty stated above shall extend for a period of TWO (2) years from date of shipment or 16,000 hours of use, whichever occurs first, with the following exceptions:

1. Components for monitoring of physical variables such as temperature, pressure, or flow are warranted for ninety (90) days from date of receipt.
2. Elastomeric components and other parts or components subject to deterioration, over which the Company has no control, are warranted for sixty (60) days from date of receipt.
3. Internal batteries are warranted for ninety (90) days from the date of receipt.
4. External batteries are warranted for one (1) year from the date of receipt.

The foregoing is in lieu of any warranty, expressed or implied, including, without limitation, any warranty of merchantability, except as to title, and can be amended only in writing by a duly authorized representative of the Company.

Contents

Revision History iii
Notices vi
Warranty viii
Chapter 1 Introduction 1-1
Safety Information 1-1
Equipment Symbols 1-4
Chapter 2 Theory of Operation 2-1
General Description 2-1
High Level Design 2-3
Detail Design 2-5
Chapter 3 Installation Instructions 3-1
Stand Assembly 3-1
Comprehensive Assembly Instructions 3-4
Customer Transport Cart Kit P/N 11372 3-8
"E" Cylinder Bracket Assembly Instructions 3-14
Assembly Instructions for Comprehensive Cart Tank Rack Bracket 3-18
AVEA Unpacking Instructions 3-19
SETTING UP THE REAR OF THE VENTILATOR 3-22
Medical Gas Connector Kit Installation Instructions 3-22
Air and Heliox Tethered "Smart" Connector Installation Instructions 3-25
Heliox "Smart" Connector Installation Instructions (DISS P/N 51000-40918) 3-27
Chapter 4 Assembly and Disassembly 4-1
General Instructions and Warnings 4-1
Recommended Tools & Equipment 4-1
Gas Delivery Engine P/N 16222A 4-4
Ventilator wheeled base 4-10
Internal Batteries P/N 68339A 4-10
Compressor/Scroll Pump P/N 51000-09750A 4-15
Enhanced Patient Monitor (EPM) Board P/N 51000-40848A 4-16

Fan Assembly P/N 51000-40861 4-18
Power Supply P/N 16388 4-19
Exhalation Valve P/N 16319 and Exhalation Flow Sensor Assembly P/N 51000-40023 4-22
Exhalation housing P/N 20030 4-22
Heater Assembly P/N 51000-40824 4-24
Microswitch, Top Cover P/N 68294 4-24
EMI Shield 4-25
Front Interface Panel P/N 51000-40635 4-25
Transition board with harness P/N 16216 4-27
Alarm Speaker P/N 51000-40818 4-28
Nebulizer Assembly P/N 51000-40026 4-29
Accumulator P/N 51000-40748 4-31
Secondary Alarm Installation (KitP/N 16316) 4-32
General Instructions and Warnings 4-32
Recommended Tools & Equipment 4-32
Functional testing of the Secondary Alarm Assembly. 4-34
Chapter 5 Operational Verification Procedure (OVP) 5-1
Set up 5-1
User Verification Tests (UVT) 5-1
Return Flow Correction to BTPS upon completion of testing. 5-10
User Interface Module (UIM) Verification 5-10
AVEA Assembly and Operational Verification Test Checklist 5-12
Field replacement and test of the AVEA Compressor Assembly 5-12
Checkout Sheet – AVEA Compressor Replacement 5-16
Power Indicators and Charging Verification 5-17
Battery Run Procedure 5-17
Air/Oxygen Inlet Pressure Verification 5-18
Breath Rate Verification. 5-19
Blending Accuracy Verification. 5-19
PEEP Verification 5-19
AVEA Assembly and Operational Verification Test Checklist 5-20

Chapter 6 AVEA Software Upgrade 6-1
Requirements: *6-1*
Procedure: *6-2*
Software Install Verification AVEA Ventilators *6-11*
Installation Verification *6-11*
Confirmation checks *6-11*
Verification and Calibration *6-12*
Test and Access of the Security System *6-12*
Chapter 7 Calibration 7-1
Screen Calibration Procedure *7-1*
Transducer Calibration *7-4*
Calibration setup *7-5*
Flow and Exhalation valve Characterization/Hysteresis Test *7-18*
Exhalation Valve Characterization Test *7-19*
Hysteresis Test *7-20*
Exhalation Valve Leak Test *7-21*
Chapter 8 Preventive Maintenance 8-1
Replacing the O2 and Air/Heliox filters. *8-2*
Replacing the Compressor Inlet & Outlet filters *8-4*
Replacing the Exhalation Diaphragm P/N 16240 .... *8-5*
Chapter 9 Troubleshooting 9-1
Chapter 10 Parts List 10-1

Appendix A..A-1
Contact & Ordering Information..*A-1*
Diagrams and Schematics..*A-2*
Specifications..*A-55*
AVEA Message Bar Text..*A-66*
Adjusting Barometric Pressure for Altitude..*A-68*
Monitor Ranges and Accuracies...*A-69*
Sensor Specifications & Circuit Resistance..*A-75*
Hot Wire Flow Sensor Specifications..*A-76*
Circuit Resistance (per EN794 –1)..*A-77*
Advanced Pulmonary Mechanics Monitored Parameters...*A-78*
Glossary...*A-85*
Index 1

Chapter 1 Introduction

Safety Information

Please review the following safety information prior to operating the ventilator. Attempting to operate the ventilator without fully understanding its features and functions may result in unsafe operating conditions.

Warnings and Cautions which are general to the use of the ventilator under all circumstances are included in this section. Some Warnings and Cautions are also inserted within the manual where they are most meaningful.

Notes are also located throughout the manual to provide additional information related to specific features.

If you have a question regarding the installation, set up, operation, or maintenance of the ventilator, contact VASYS Respiratory Care customer care as shown in Appendix A, Contact & Ordering Information.

Terms

WARNINGS	identify conditions or practices that could result in serious adverse reactions or potential safety hazards.
CAUTIONS	identify conditions or practices that could result in damage to the ventilator or other equipment.
NOTES	identify supplemental information to help you better understand how the ventilator works.

Warnings

Warnings and Cautions appear throughout this manual where they are relevant. The Warnings and Cautions listed here apply generally any time you work on the ventilator.

- Alarm loudness must be set above ambient sound in order to be heard.
- Due to possible explosion hazard, the ventilator should not be used in the presence of flammable anesthetics.
- An audible alarm indicates an anomalous condition and should never go unheeded.
- Anti-static or electrically conductive hoses or tubing should not be used within the patient circuit.
- If a mechanical or electrical problem is recognized while running the Operational Verification Tests, or while operating the ventilator, the ventilator must be removed from use until the problem has been identified and resolved.
- The functioning of this equipment may be adversely affected by the operation of other equipment nearby, such as high frequency surgical (diathermy) equipment, defibrillators, short-wave therapy equipment, “walkie-talkies,” or cellular phones.
- Water in the air supply can cause malfunction of this equipment.

- Do not block or restrict the Oxygen bleed port located on the instrument back panel. Equipment malfunction may result.
- Electric shock hazard – Ensure the ventilator is disconnected from the AC power supply before performing and repairs or maintenance. When you remove any of the ventilator cover panels, immediately disconnect the internal battery “quick release” connector before working on the ventilator. If the ventilator has an external battery installed, ensure that the external battery is unplugged from the rear panel before proceeding
- A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation. Upon loss of protective ground, all conductive parts including knobs and controls that may appear to be insulated, can render an electric shock. To avoid electrical shock, plug the power cord into a properly wired receptacle, use only the power cord supplied with the ventilator, and make sure the power cord is in good condition.

The following warnings must be read and understood before performing the procedures described in this manual.

- Under no circumstances should this medical device be operated in the presence of flammable anesthetics or other volatile materials due to a possible explosion hazard.
- Liquid spilled or dripped into the unit may cause damage to the unit or result in an electrical shock hazard.
- Oxygen vigorously accelerates combustion. To avoid violent ignition, do not use any gauges, valves, or other equipment that has been exposed to oil or grease contamination.
- Do not use this device if any alarm/alert function is inoperative. To do so could result in a malfunction without warning, possibly resulting in personal injury, including death or property damage.
- All tubing and fittings used to connect high pressure gas from the source to the test equipment and from the test equipment to the device being tested must be capable of withstanding a minimum supply pressure of 100 psi (7.03 kg/cm2). The use of tubing and fittings not capable of withstanding this pressure could cause the tubing to rupture, resulting in personal injury or property damage.
- When verifying the operation of this medical device, do not breathe directly from the machine. **Always** use a fresh bacterial filter and test circuit. Failure to do so may constitute a hazard to the health of the service person.
- If any of the procedures outlined in this document cannot be verified, do not use this device and refer it to VIASYS Respiratory Care or a VIASYS Respiratory Care authorized service facility or a VIASYS Respiratory Care trained hospital service technician.

Cautions

The following cautions apply any time you work with the ventilator.

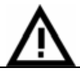
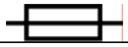
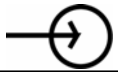
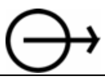
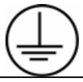
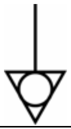
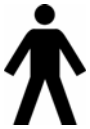
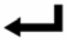
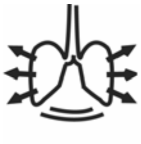
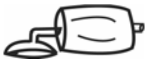
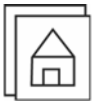
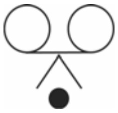
- Ensure that the voltage selection and installed fuses are set to match the voltage of the wall outlet, or damage may result.
- A battery that is fully drained (i.e. void of any charge) may cause damage to the ventilator and should be replaced.
- All accessory equipment that is connected to the ventilator must comply with CSA/IEC601/UL2601.
- To avoid damage to the equipment, clean the air filter regularly.

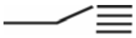
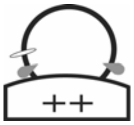
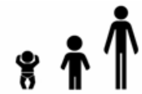
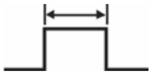
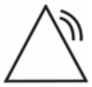
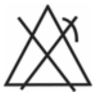
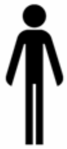
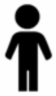
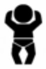
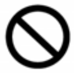
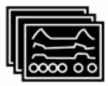
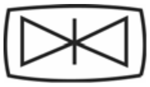
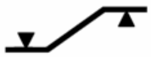
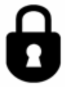
The following cautions apply when cleaning the ventilator or when sterilizing ventilator accessories.

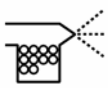
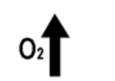
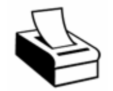
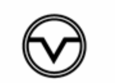
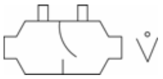
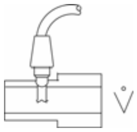
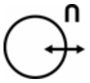
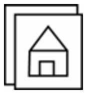
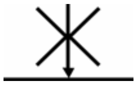
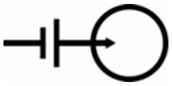
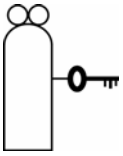
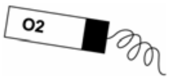
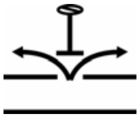
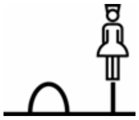
- Do not sterilize the ventilator. The internal components are not compatible with sterilization techniques.
- Do not gas sterilize or steam autoclave tubing adapters or connectors in place. The tubing will, over time, cause poor connection and possible leaks.
- DO NOT submerge the ventilator or pour cleaning liquids over or into the ventilator.
- Do not use MEK, Trichloroethylene or similar solutions as damage to surface may result. Do not allow any liquid to spill or drip into the ventilator.
- Circuit boards are subject to damage by static electricity. Do not touch components, circuit, or connector fingers with hands. Handle only by edges.

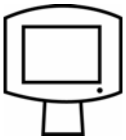
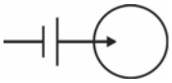
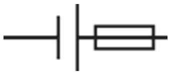
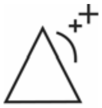
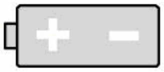
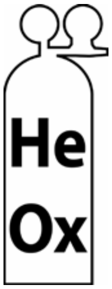
Equipment Symbols

The following symbols may be referenced on the ventilator or in accompanying documentation

Symbol	Source/Compliance	Meaning
	Symbol #03-02 IEC 60878	Indicates ATTENTION, consult ACCOMPANYING DOCUMENTS
	Symbol #5016 IEC 60417	This symbol indicates a FUSE.
	Symbol #5034 IEC 60417 Symbol #01-36 IEC 60878	This symbol indicates INPUT.
	Symbol #5035 IEC 60417 Symbol #01-37 IEC 60878	This symbol indicates OUTPUT
	Symbol #5019 IEC 60417 Symbol #01-20 IEC 60878	This symbol indicates protective EARTH (ground).
	Symbol #5021 IEC 60417 Symbol # 01-24 IEC 60878	This symbol indicates the EQUIPOTENTIAL connection used to connect various parts of the equipment or of a system to the same potential, not necessarily being the earth (ground) potential (e.g., for local bonding).
	Symbol # 5333 IEC 60417 Symbol #02-03 IEC 60878	This symbol indicates TYPE B equipment, which indicates equipment that provides a particular degree of protection against electric shock, particularly with regards to allowable leakage current and reliability of the protective earth connection.
~	Symbol #5032 IEC 60417 Symbol #01-14 IEC 30878	This symbol is located on the rating plate. It indicates the equipment is suitable for alternating current.
I	Symbol #5007 IEC 60417 Symbol #01-01 IEC 60878	Indicates ON (Power)
O	Symbol #5008 IEC 60417 Symbol #01-02 IEC 60878	Indicates OFF (Power)
 ACCEPT	Symbol #0651 ISO 7000	Horizontal return with line feed. Indicates ACCEPT entered values for a specific field.
	VIASYS Respiratory Care Symbol	Indicates PATIENT EFFORT
	VIASYS Respiratory Care symbol	Indicates MANUAL BREATH
	VIASYS Respiratory Care Symbol	MAIN SCREEN
	Symbol #417 IEC 5102	EVENT READY

	VIASYS Respiratory Care Symbol	MODE
	VIASYS Respiratory Care Symbol	ADVANCED SETTINGS
	VIASYS Respiratory Care Symbol	SET-UP for patient Data
	VIASYS Respiratory Care Symbol	SiPAP Duration
CE	MDD Directive 93/42/EEC	CE Mark
	Symbol #5307 IEC 60417	ALARM RESET
	Symbol #5319 IEC 60417	ALARM SILENCE
	VIASYS Respiratory Care symbol	ADULT patient
	VIASYS Respiratory Care symbol	PEDIATRIC patient
	VIASYS Respiratory Care symbol	NEONATAL (Infant) patient
 CANCEL	Graphical Symbol in general use internationally for "DO NOT"	CANCEL, do not accept entered values.
	VIASYS Respiratory Care symbol	Select DISPLAYED SCREEN function.
	Symbol 5467 IEC 60417	FREEZE the current display.
	VIASYS Respiratory Care symbol	Enable the ALARM LIMITS screen
	VIASYS Respiratory Care symbol	This symbol indicates a CONTROL LOCK.

	VIASYS Respiratory Care symbol	NEBULIZER port
	VIASYS Respiratory Care symbol	Increase OXYGEN
	VIASYS Respiratory Care symbol	PRINT SCREEN
	VIASYS Respiratory Care symbol	SUCTION port
	VIASYS Respiratory Care symbol	VARIABLE ORIFICE FLOW SENSOR connection
	VIASYS Respiratory Care symbol	HOT WIRE FLOW SENSOR connection
	VIASYS Respiratory Care symbol	ANALOG IN/OUT connection
	VIASYS Respiratory Care symbol	Display the MAIN SCREEN
	VIASYS Respiratory Care symbol	DO NOT BLOCK PORT
	VIASYS Respiratory Care symbol	EXTERNAL BATTERY connection
	VIASYS Respiratory Care symbol	Indicates GAS ID port
	VIASYS Respiratory Care symbol	OXYGEN SENSOR connection
	VIASYS Respiratory Care symbol	OVERPRESSURE relief
	VIASYS Respiratory Care symbol	REMOTE NURSE CALL connection

	VIASYS Respiratory Care symbol	UNIVERSAL INTERFACE MONITOR connection
	VIASYS Respiratory Care Symbol	This symbol indicates an EXTERNAL BATTERY INPUT
	VIASYS Respiratory Care Symbol	This symbol indicates an INTERNAL BATTERY FUSE
	VIASYS Respiratory Care Symbol	This symbol indicates ALARM LOUDNESS
	VIASYS Respiratory Care Symbol	Operating on Battery Indicator
	VIASYS Respiratory Care Symbol	Operating on Heliox

Chapter 2 Theory of Operation

General Description

AVEA is a software driven, servo-controlled ventilator designed to meet the requirements of neonate to adult patients. The design intent of the device is to provide a high performance software-driven gas delivery engine, which is capable of providing a full range of volume and pressure ventilation including dual limb NIPPV. This affords the flexibility of developing new modes of ventilation with no impact to the basic gas delivery engine. In addition, the device will contain a graphical user interface (GUI) that utilizes a 12.1-inch SVGA color LCD screen with integral touch screen. The GUI will be used to change settings and operating parameters as well as providing real time waveforms, digital monitors, and alarms. The device also contains an internal battery that serves as a backup in case of loss of hospital AC power. The Custom Cart may be equipped with tank holder, external batteries and battery tray for use of the AVEA during inter-facility transport.

There are three models of AVEA; comprehensive, plus and standard. These are shown in table 2.1 based on the same basic platform. Additional models may be developed in the future by adding or removing software and/or hardware features to the existing platform.

The AVEA is a fourth generation, servo-controlled, software-driven ventilator. It has a dynamic range of breathing gas delivery that provides for neonatal through adult patients. Its revolutionary user interface module (UIM) provides maximum flexibility with simple operator interaction. It has a flat panel color LCD with real time graphic displays and digital monitoring capabilities, a touch screen for easy interaction, membrane keys and a dial for changing settings and operating parameters. A precision gas delivery engine with servo controlled active inhalation and exhalation improves performance over previous generations.

The AVEA has been designed to function using most commonly available accessories. It is easy to clean and its design does not allow liquids to pool on the casing, reducing the likelihood of fluid leakage into the body of the ventilator.

There are three models of AVEA to choose from: The Comprehensive, Plus, and the Standard. The following matrix details the standard and optional functions available with each model.

Functions & Accessories	Standard	Plus	Comprehensive
Modes	All	All	All
Proximal Hot Wire Flow Sensing	☒	☒	☒
Synchronized Nebulizer	☒	☒	☒
24 Hour Trending	☒	☒	☒
Internal Battery	☒	☒	☒
Full Color Graphics Display	☒	☒	☒
Loops and Waveforms	☒	☒	☒
Standard Cart	☒	☒	
Proximal Variable Orifice flow sensing		☒	☒
Proximal Airway Pressure Monitoring		☒	☒
Tracheal Pressure Monitoring			☒
Esophageal Pressure Balloon			☒
Internal Compressor			☒
Heliox Delivery			☒

Optional Functions & Accessories			
Custom Cart	Option	Option	Included
External Battery (on custom cart only)	Option	Option	Option
Gas Tank Holder (on either cart)	Option	Option	Option
Internal Compressor	Option	Option	Included
Heliox Delivery	Option	Option	Included

High Level Design

AVEA has been designed with three basic modules, the user interface module (UIM), the pneumatics module (PM), and the stand (see Figure 1). The UIM contains a graphical user interface (GUI) which utilizes a 12.1-inch SVGA color LCD screen with integral touch screen. The UIM also contains a control PCB that has two microprocessors, control and monitor. The monitor processor manages the GUI, while the control processor has the real time control system that controls all of the mechanical valves in the PM. The UIM communicates with the PM via a high-speed serial channel (HSSC). The HSSC also provides power to the UIM.

The pneumatics module (PM) contains all of the mechanical valves, sensors, analog electronics, power supply including the internal batteries, and the optional internal compressor. The pneumatics module takes high-pressure air or 80/20 heliox and oxygen from an external wall source or other high-pressure source. It filters the gas and blends them through a stepper motor controlled blender according to the front panel settings. It then delivers the appropriate pressure or volume via a high-speed proportional solenoid with flow sensor feedback. The high-speed control system occurs every 2 msec and is computed in the control microprocessor in the UIM. The delivered gas flows to the patient through a safety valve that has a mechanical over pressure relief valve as well as a sub-ambient valve. The gas is forced into the patient by closing the servo-controlled voice coil exhalation valve, which is also controlled by the control microprocessor in the UIM. The patient is allowed to exhale by the voice coil exhalation valve, which also maintains baseline pressure or PEEP. The exhaled gas exits the patient through the expiratory limb of the patient circuit to an integral heated expiratory filter to an external flow sensor and out the exhalation valve to ambient air.

The pneumatics module has several additional capabilities. First it uses either air or 80/20 heliox for an input gas, and corrects all blending, volume delivery, volume monitoring and alarming, and FiO_2 monitoring and alarming based on the correct gas density. The system knows what the gas is, by a patent pending gas ID that identifies the appropriate inlet DISS fitting with the gas that is being delivered, which creates an inherently safer system for delivering heliox. The second capability is the optional back up compressor that is battery backed up for a minimum of 30 minutes by a fully charged internal battery, which allows for uninterrupted ventilation during a loss of AC power. The third feature is the ability to monitor volume either at the expiratory limb of the machine or at the patient wye. This allows for more accurate patient monitoring especially in infants while allowing the convenience of an expiratory limb flow sensor protected by a heated filter. Finally, the fourth feature is the ability to measure tracheal and esophageal pressures, which is currently commercially available only on other VIASYS (Bear/Bird) ventilators.

The stand is used to support the ventilator at an ergonomically correct height. It may contain an optional external battery for extended use with AC power (custom stand only). It also has an optional O_2 tank bracket so that the unit can be used without wall oxygen during inter-hospital transport. The stand does not contain active electronic or mechanical components other than the optional external batteries, which are charged when connected to A/C Power.

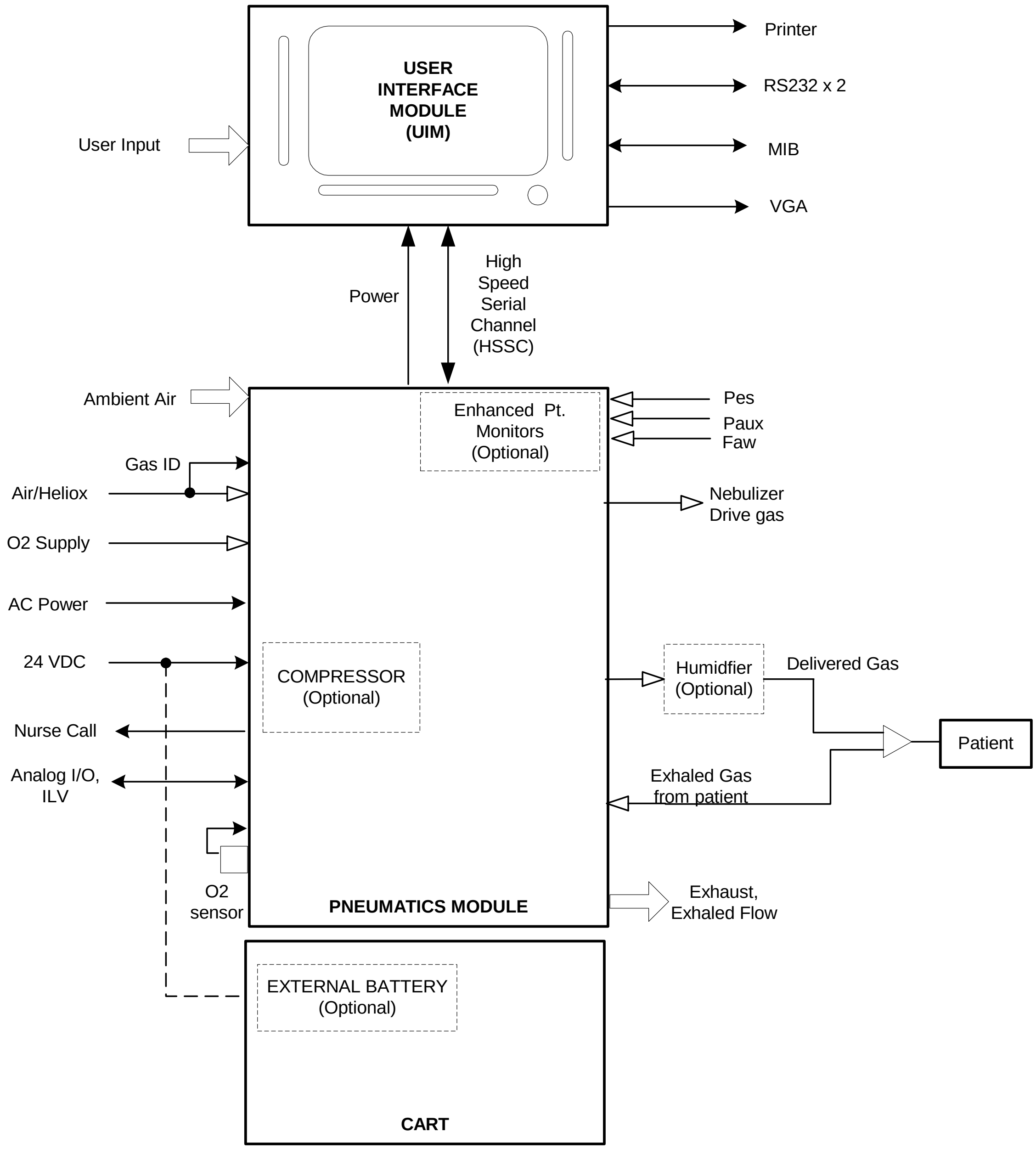

USER INTERFACE MODULE (UIM)
Printer
RS232 x 2
MIB
VGA
User Input
Power
High Speed Serial Channel (HSSC)
Ambient Air
Enhanced Pt. Monitors (Optional)
Pes
Paux
Faw
Gas ID
Air/Heliox
Nebulizer Drive gas
O2 Supply
AC Power
24 VDC
COMPRESSOR (Optional)
Humidfier (Optional)
Delivered Gas
Patient
Nurse Call
Analog I/O, ILV
Exhaled Gas from patient
O2 sensor
PNEUMATICS MODULE
Exhaust, Exhaled Flow
EXTERNAL BATTERY (Optional)
CART

Figure 2-3 High End Device Modular Diagram

Detail Design

User Interface Module (UIM)

The UIM consists of a 12.1-inch, 800x600 active matrix LCD with an analog resistive touch screen overlay, a back light inverter, a set of membrane key panels, an optical encoder, and a Control PCB. Software and the touch screen provide a set of context sensitive soft keys. The membrane panel provides a set of hard (permanent) keys for dedicated functions. Selecting the function with a soft key and adjusting the setting using the optical encoder changes a parameter. The parameter is accepted or canceled by pressing the appropriate membrane key.

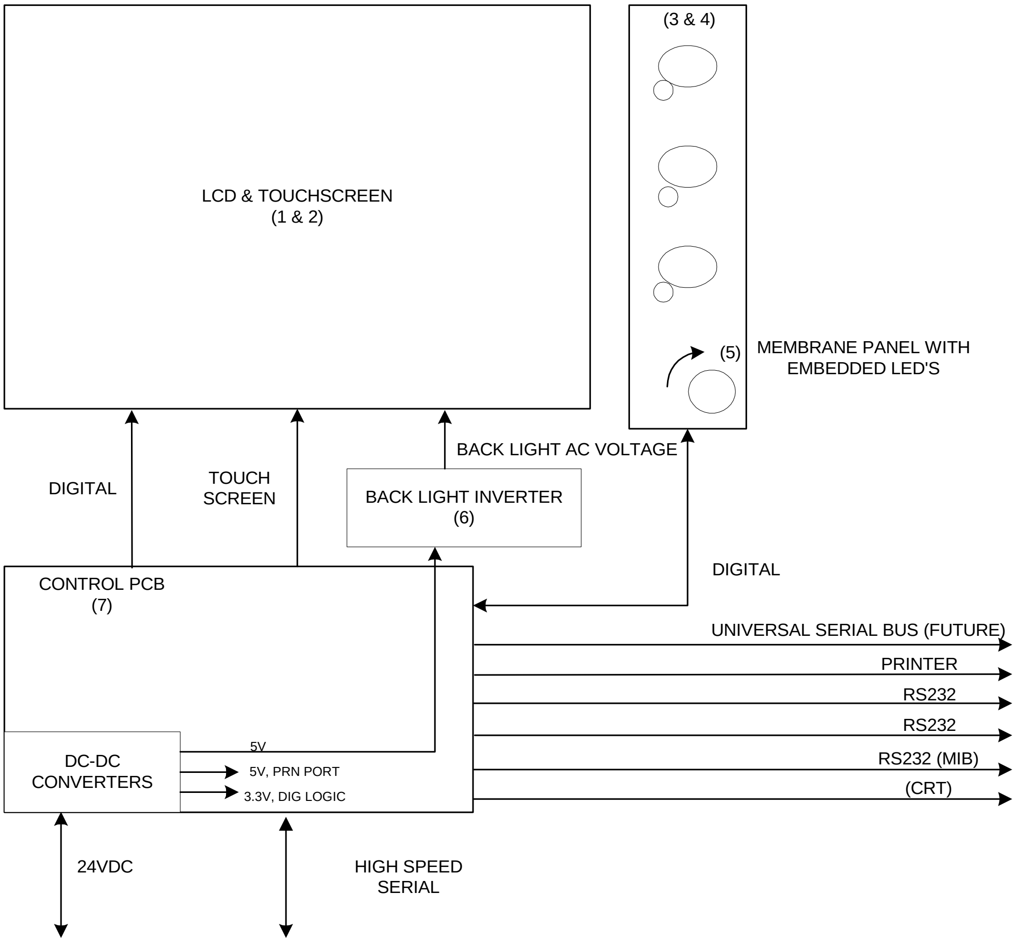

LCD & TOUCHSCREEN
(1 & 2)
(3 & 4)
(5)
MEMBRANE PANEL WITH EMBEDDED LED'S
BACK LIGHT AC VOLTAGE
DIGITAL
TOUCH SCREEN
BACK LIGHT INVERTER
(6)
DIGITAL
CONTROL PCB
(7)
UNIVERSAL SERIAL BUS (FUTURE)
PRINTER
RS232
RS232
RS232 (MIB)
(CRT)
DC-DC CONVERTERS
5V
5V, PRN PORT
3.3V, DIG LOGIC
24VDC
HIGH SPEED SERIAL

Figure 2-4 User Interface Design Module Block Diagram

The UIM performs all ventilator control functions, gas calculations, monitoring and user interface functions. The UIM uses a Graphical User Interface (GUI) via the active matrix SVGA LCD and resistive touch screen to provide system and patient information to the user and to allow the user to modify ventilator settings. The Control PCB (with two micro-controllers, RAM, ROM and support electronics) provides all ventilator functions. The Control micro-controller (MCU) performs all gas calculations; controls all valves, solenoids, and electronics required to deliver blended gas to the patient. The Monitor MCU handles all user interface requirements, including updating the active matrix liquid crystal display (LCD), monitoring the membrane keypad, analog resistive touch screen, and optical encoder for activity. The Monitor MCU also performs all the input/output functions of the UIM, including RS-232, printer, video output, and communication to patient monitors. Communication between the Control and Monitor MCU’s is accomplished via an 8 bit dual port SRAM. In addition, both MPU's monitor each other and both are independently capable of activating the fail safe system.

The UIM is self-contained and is tethered to the pneumatics module with a high-speed data and power cable. All valves are contained in the pneumatics module; the control MCU controls all ventilator functions via the high-speed serial channel (HSSC). The Monitor MCU provides additional input/output functions contained in the ventilator. These functions include analog outputs, independent lung ventilation, and nurse call and are updated by the Monitor MCU via the HSSC.

Liquid Crystal Display

The liquid crystal display (LCD) provides graphical and digital feedback to the clinician. The panel is a 12.1” SVGA, 800x600 pixel, active matrix LCD. The LCD is used to implement the graphical user interface (GUI). It provides all of the adjustable controls and alarms, as well as displays waveforms, loops, digital monitors and alarm status in real time.

Touch Screen

The touch screen in conjunction with the LCD provides a set of software configurable soft keys. The software allows the keys to be context sensitive. The touch screen is a 12.1” analog resistive overlay on a piece of glass, which is placed over the LCD. It has a resolution of 1024x1024. Physically the touch screen, consists of two opposing transparent resistive layers separated by insulating spacers. Actuation brings the two opposing layers into electrical contact. The Y coordinate is determined by applying a voltage from top to bottom on the top resistive layer. This creates a voltage gradient across this layer. The point of contact forms a voltage divider, which is read by the analog-to-digital converter. The X coordinate is determined by applying a voltage from left to right on the bottom resistive layer. Again this creates a voltage gradient and the point of contact forms a divider, which is read with an analog-to-digital converter.

Membrane Panel

The membrane panel provides a set of permanent dedicated keys, which allow the clinician to change certain ventilator functions. The membrane panel will provide visual status to the clinician via embedded light emitting diodes (LEDs). The membrane panel consists of membrane switches, which are read by the monitor CPU. The switches form a matrix of rows and columns. A key closure causes an interrupt to the monitor CPU, which responds by scanning the key matrix to determine which key has been pressed.

Light Emitting Diodes (LEDs)

Some of the membrane keys require LED’s to indicate when the key is active. The LED’s are embedded into the membrane panels.

Optical Encoder

The optical encoder allows the clinician to change settings. The setting to be changed is selected by pressing a soft key on the LCD and then turning the optical encoder to change the value. When the encoder is rotated two pulse streams are generated, phase A and B. When the encoder is turned clockwise, phase A leads B by 90 degrees. When the direction is counter clockwise, phase B leads A by 90 degrees. The electronics uses the phase information to drive an up-down counter, which is read by the monitor CPU. The optical encoder is not interrupt-driven and therefore must be polled by the monitor CPU.

Back Light Inverter

The back light inverter converts 5 VDC into the high frequency AC voltage necessary to power the LCD back light, which is used to illuminate the LCD.

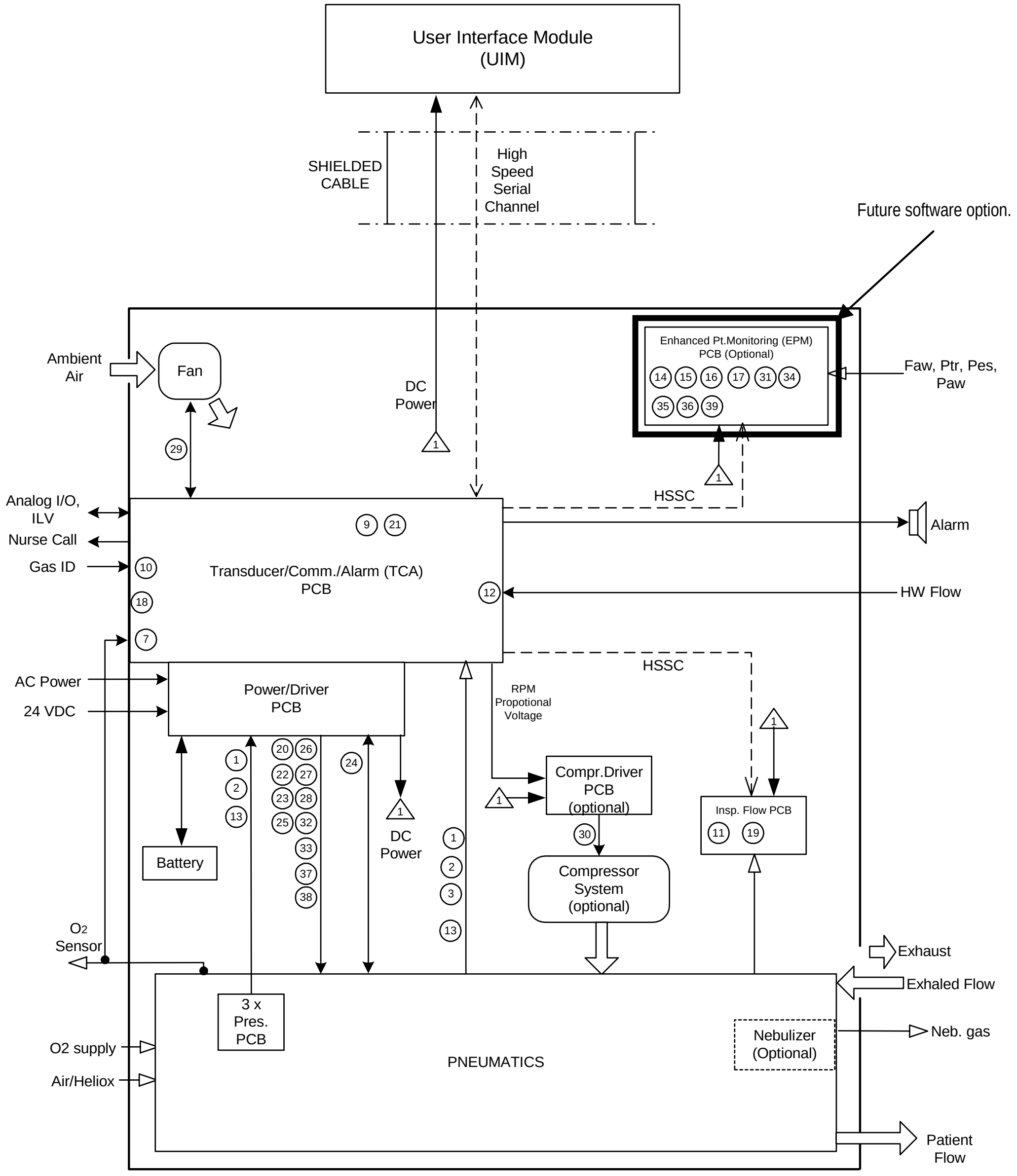
Control PCB

The control PCB consists of two micro-controllers, the control CPU and the monitor CPU, both of which are 100 MHz ELAN 410’s. The control and associated circuitry (RAM, ROM, etc) micro controllers perform all ventilator control functions including the 2 msec closed loop flow control servo and the 2 msec closed loop exhalation valve control servo. The monitor micro-controller manages the GUI and performs all user input and output including the RS-232 ports, printer port, video out, and MIB port. The two processors communicate with each other via a dual port RAM. The control processor communicates with the pneumatics module via a high-speed serial channel (HSSC - 4 Mbits/sec).

Each processor has 8 Mbytes of DRAM, and one Mbyte of flash memory for program storage. In addition, the monitor circuitry also has a second one Mbyte of flash memory for saving control settings and trended data for clinical parameters. The control PCB also contains a DC-to-DC converter to regulate the incoming 24 VDC to the voltages used by the UIM. Finally, the control PCB also contains all of the circuitry necessary to scan the membrane panels, touch screen, and optical encoder, as well as the video controller necessary to drive the SVGA LCD screen.

Pneumatics Module

The pneumatics module (PM) consists of a power supply system including internal NiMH batteries, a transducer/ communication/alarm PCB (TCA PCB), the pneumatics, a heated expiratory system, a fan, an optional internal compressor, a built-in nebulizer system, and an audible alarm. The PM communicates with the UIM (User Interface Module) via the HSSC described above.


User Interface Module
(UIM)
SHIELDED
CABLE
High
Speed
Serial
Channel
Future software option.
Ambient
Air
Fan
DC
Power
1
29
Enhanced Pt.Monitoring (EPM)
PCB (Optional)
14
15
16
17
31
34
35
36
39
Faw, Ptr, Pes,
Paw
1
HSSC
Analog I/O,
ILV
Nurse Call
Gas ID
9
21
10
Transducer/Comm./Alarm (TCA)
PCB
18
12
7
Alarm
HW Flow
HSSC
AC Power
24 VDC
Power/Driver
PCB
RPM
Propotional
Voltage
1
20
26
24
2
22
27
13
23
28
25
32
33
37
38
1
DC
Power
Compr.Driver
PCB
(optional)
1
30
Insp. Flow PCB
11
19
Battery
1
2
3
13
Compressor
System
(optional)
O2
Sensor
Exhaust
Exhaled Flow
3 x
Pres.
PCB
Nebulizer
(Optional)
Neb. gas
O2 supply
PNEUMATICS
Air/Heliox
Patient
Flow

Reference: Pneumatic Schematic P/N 51K-09742 Rev X1

Figure 2-5   Pneumatics Module Block Diagram

Power Supply System

The power supply system, consists of a power inlet module, and a medical grade 350-watt power supply, the power driver PCB, and a set of internal 12 VDC NiMH batteries connected in series. The power inlet system accepts a standard IEC medical grade power cord and allows the system to be configured externally for use with 100 to 240 VAC 50/60 Hz power. AC power is converted to 34 VDC by the internal medical grade power supply, which is also power factor corrected. The power driver PCB converts the 34 VDC from the power supply or the 24 VDC from the internal or external batteries to the appropriate voltages used by the rest of the system. The power driver PCB also contains the charging circuit for both the internal and external batteries, as well as the drivers for the flow control, exhalation valve, and multiple solenoids. The internal 4.5 Ah NiMH batteries can power the entire system including the internal compressor for 30 minutes, or 2 hours without the compressor. With the external 17 Ah lead acid batteries combined with the internal battery powers the entire system, including compressor, will run for 2 hours on batteries, and greater than 8 hours without compressor.

Transducer/Alarm PCB (TCA PCB)

The TCA PCB consists of circuitry for the audible alarm, the wye hot wire flow sensor, the gas ID, the inspiratory and expiratory pressure transducers, the source gas pressure transducers, the exhaled flow sensor, the FiO2 cell, and communications with the UIM. It also contains the nurse call, and analog input and output.

A 68HC705 micro-controller is used to generate alarm waveforms for an ASTM F1463-93 compliant alarm. A super capacitor is used to provide a minimum if 120 seconds of power without wall AC or a battery.

Analog circuitry is provided to signal condition the wye Hot Wire Flow Sensor signal and a 12 bit ADC is used to digitize the signal. A Flow Sensor Fail signal is provided to allow the Control Processor to determine when the flow sensor wire is broken. The Flow Sensor EEPROM is SPI bus compatible and is read at power up and when a Flow Sensor is connected.

The air inlet fitting contains a resistor for determining which gas source is connected to the Air inlet, Air (5K ohm) or Heliox (10K ohm). The type of gas connected is determined with a resistor divider, one half of the divider is contained in a connector and the other half is located on the TCA. The resistor contained in the connector is different for each gas source and therefore produces a different voltage output from the divider. The output of the divider is read via an ADC.

Inspiratory and expiratory pressure transducers and associated signal conditioning are digitized on the TCA PCB. The control processor reads the digitized data via the HSSC. The air, oxygen, and blended gas pressure transducers and associated signal conditioning are on separate PCBs for ease of mounting. The amplified signals are cabled to the TCA where they are digitized and communicated to the control processor via the HSSC.

Exhaled flow is measured with a VARFLEX® Exhaled Flow Sensor. The VARFLEX® Flow Sensor uses a variable orifice with pressure taps on either side of the orifice. The TCA uses a low-pressure pressure transducer and analog circuitry to measure the flow proportional pressure drop across the orifice.

Integrated circuit temperature sensors are signal conditioned and digitized by the TCA electronics. The exhalation and ambient temperature sensors are cabled to the TCA PCB. The output of oxygen cell is also signal conditioned and digitized on the TCA.

There are four 10-bit analog output channels on the TCA for pressure, flow, volume, and breath phase respectively. They have a full scale of 0 to 5 VDC with 10-bit resolution. In addition, there are 8 programmable analog inputs that can be used to display external signals. They are digitized with a 10 bit DAC, and are scalable from 0 to 1VDC, 0 to 5 VDC, and 0 to 10 VDC.

Finally, there is a nurse call output that can be configured as either normally open or normally closed. The nurse call shall be activated for all medium and high priority alarms except when alarm silence is activated.

Pneumatics-Gas Delivery Engine

The GDE (Gas Delivery Engine) receives and conditions supplied Oxygen, Air, or Heliox from an external and/or internal (compressor) sources. It then mixes the gas to the concentration required and delivers the desired flow or pressure to the patient.

The Gas Delivery Engine begins with the Inlet Pneumatics. The Inlet Pneumatics accepts clean O_2, Air, or Air alternate external gas; it provides extra filtration and regulates air and O_2 gas before entering the Oxygen Blender. The Oxygen Blender mixes the gases to the desired concentration before reaching the Flow Control Valve. The Flow Control Valve controls the flow rate of the gas mixture to the patient. Between the Oxygen Blender and Flow Control Valve, the Accumulator System is installed to provide peak flow capacity. The Flow Sensor provides information about the actual inspiratory flow for closed loop servo control. The gas is then delivered to the patient through the Safety/Relief Valve and Outlet Manifold.

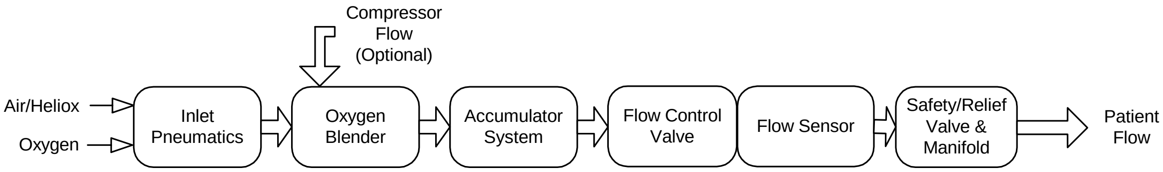


Figure 2-6 Gas Delivery Engine Block Diagram

Inlet System

The Inlet Pneumatics conditions and monitors the air, oxygen, and/or helium-oxygen mix supplies entering the ventilator. The Inlet Pneumatics has Inlet Filters that remove aerosol and particulate contaminants from the incoming gas supplies. The downstream Air Regulator and O_2 Relay combination is used to provide balanced supply pressure to the gas blending system. The Air Regulator reduces the air supply pressure to 11.0 PSIG and pilots the O_2 Relay to track at this same pressure. This system automatically regulates to 9.5 PSIG when the optional internal compressor is being used.

In the event the supply air pressure falls below the acceptable level, the internal compressor will be activated to automatically supply air to the blender. Without an optional internal compressor, the Crossover Solenoid opens delivering high-pressure oxygen to the Air Regulator, allowing the Air Regulator to supply regulated O_2 pressure to pilot the O_2 Relay. In addition, the Oxygen Blender simultaneously moves to the 100% O_2 position, so that full flow to the patient is maintained.

In the event of an oxygen supply pressure drop below a pressure threshold, the Crossover Solenoid stays closed, the blender moves to 21% O_2, and the regulated air pressure provides 100% air to the blending system.

Oxygen Blender

The Blender receives the supply gases from the Inlet Pneumatics System and blends the two gases to the user-selected value. It consists of three sub-systems, valve, stepper motor, and drive electronics. The Oxygen Blender PCB provides the electronics needed to control the Oxygen Blender stepper motor. The stepper motor controls the oxygen blender and is stepped in 1.8-degree increments. The Blender has a disk, which is positioned during calibration. One end of the disk will interrupt the optical interrupter when the valve position is closed and the other end will only interrupt in case the Blender goes approximately one full revolution due to loss of position. An EEPROM will be used to store the number of steps required to travel from the home position to the full open position of the valve, the PCB revision, and manufacturing date.

Accumulator

The Accumulator stores blended gas supplied from either regulated wall gas or an optional internal compressor. The accumulator provides the capability to achieve volume capacity at relatively lower pressure, resulting in lower system power requirements. It stores blended gas during patient exhalation cycles which maximizes system efficiency. The Accumulator gas pressure cycles between 3 and 11 PSIG depending on the Tidal Volume. The system efficiency is improved because a smaller compressor can be used to meet Tidal Volume while the accumulator provides the extra gas needed to meet the patient’s peak flow demand. A 6-L/MIN accumulator bleed orifice allows gas concentration in the accumulator to match the oxygen blender setting in a maximum time of 1 minute. A pressure relief valve will provide protection from pressure exceeding 12 PSIG to the accumulator.

Flow Control System

The Flow Control System provides the desired flow rate of gas to the patient. Real time feedback from the Flow Sensor through the Control System provides flow correction in the Flow Control Valve. The Flow Control System consists of a Proportional Voltage Servo Valve controlled by the real time measurement (2 ms) of flow through a variable orifice Flow Sensor. The variable orifice effect is created by a thin circular shaped piece of stainless steel that is mounted from an extended side in the flow stream. The flow will bend the metal creating a variable orifice. The flow proportional pressure drop is characterized and used for flow measurement. The Servo Control Electronics/Software receives and sends the control signals to the Flow Control System Components. Flow Control Valve adjustments are made for gas temperature, gas density, and backpressure.

Safety/Over Pressure System

The Safety/Pressure Relief Valve prevents over-pressure in the breathing circuit, and provides a connection between the patient and ambient air during a gas delivery failure from the Ventilator. A Check Valve downstream of the Safety/Pressure Relief Valve prevents flow from the patient back into the Ventilator. Pressure Relief around the Check Valve is accomplished through an orifice installed in parallel to the Check Valve. The Safety/Relief Valve allows the patient to breathe room air in the event of a ventilator or power failure. It also acts as an independent relief valve, which limits the maximum pressure the ventilator can deliver.

Hour Meter

The Hour Meter provides a means of monitoring the number of hours the ventilator is in use. In addition, it is used by the ventilator to track compressor hours of operation. A Curtis 201-hour meter is used. The hour meter is active as long as 5 volts is available. The hour meter outputs a continuous stream of serial data. The control processor reads the data by synchronizing to the start pulse of the data stream and then reading each successive bit. The hour meter does not have a visible readout and therefore must be read by software. The hour meter is hard mounted in the pneumatics module and is cabled to the TCA PCB.

Heated Expiratory System

The heated expiratory system consists of a heated filter contained in a chamber with a micro-controller controlled heater, a water collector, an exhalation flow sensor, and a servo-controlled exhalation valve. The expiratory system is located at the end of the patient circuit; the Exhalation Valve regulates gas flow out of the patient circuit. Diaphragm position of the voice coil type active Exhalation Valve controls the exiting gas flow rate and patient circuit pressure with precision. Pressure feedback data is sent to the Electronic Control Unit continuously, which interprets the data, and based upon current ventilator settings, signals back to position the Exhalation Valve Diaphragm. Since the ventilator will be used in neonate, pediatric and adult ranges, the exhalation servo can be optimized for each circuit type to be used. The Water Collector and Filter remove contaminates from the gas flow before they reach the Flow Sensor, Exhalation Valve, or the environment. Also, warm air exhausts through the Exhalation System enclosure to the atmosphere. The system incorporates a resettable fuse.

The expiratory flow sensor determines flow by measuring the pressure difference across a variable orifice. The variable orifice is created with a thin circular shaped piece of stainless steel that is mounted on a hinge in the flow stream from an extended side. As flow increases and decreases the hinged flap creates the variable orifice effect. The pressure drop across the orifice is measured by a pressure transducer on the TCA and converted to flow by the software in the control micro-controller.

As stated earlier, the exhalation valve is a voice coil with a diaphragm. The exhalation valve controls circuit pressure, permits only one-way flow, and provides pressure relief above a set level during inspiration. The exhalation valve is controlled with a closed loop servo contained in the control micro-controller and is updated every 2 msec.

The water collector stores water that condenses in the expiratory limb of the patient circuit protecting the filter and exhalation valve system. The water collector consists of a vial and an inlet and outlet shaped fitting. A male 22 mm outside taper (15mm inside taper) connector is provided for the patient circuit connection and a 22 mm female connector is used for the heated filter.

The bacteria filter removes particles from the gas that exceed 0.3µm in size. The excess water drains into the water collector reducing the risk of contamination of the exhalation valve system. Warm heated air flows past the outside surface of the filter reducing condensation in the filter. The filter is an off-the-shelf purchased part.

Fan

A 40 cfm fan runs at all times to keep the internal temperature of the pneumatics module as close to ambient as possible. In addition, the fan forces flow out past the expiratory filter. A heater heats the gas as it exits in order to heat the filter as described above.

Compressor System (Optional)

The Compressor System provides 3 to 9.5 PSIG air pressure to the system when wall air is not available. The Compressor has two opposing machined aluminum involutes that are called Scrolls. One scroll orbits a fixed scroll forming air pockets that get progressively smaller as they travel from the outer to inner regions of the involute, compressing the gas. The shaft rotation from a brushless DC motor powers the orbiting scroll within the fixed scroll through an eccentric shaft. It operates at 800 to 3,000 RPM using about 100 watts at 24 VDC. A Pressure Servo improves power efficiency and noise by matching ventilator demand with supplied compressed air. While the accumulator is the device which handles the peak flow demand, the servo operates the compressor at a level which matches the minute ventilation of the patient.

Nebulizer System

The Nebulizer system provides a 10 PSIG source of blended gas for an external nebulizer. The gas will only be delivered during the inspiratory cycle of a breath so that the delivery of nebulized gas will be synchronized with the patient's breathing. Most manufacturers' nebulizers draw between 4 and 8 L/MIN at 10 PSIG. The Nebulizer is disabled during use of the optional internal compressor.

Enhanced Patient Monitoring PCB (Optional-EPM)

The Enhanced Patient Monitoring PCB provides Esophageal and Tracheal pressure monitoring and VARFLEX® wye flow sensing. The EPM PCB contains all of the signal condition as well as the pressure transducers for the esophageal pressure, tracheal pressure, and wye flow sensing. In addition, it contains a 12-bit serial ADC to convert the pressures to digital data. The TCA provides the chip select and solenoid control signals. Three solenoids are used to control the evacuation and filling of the Esophageal Balloon. Two solenoids are used to provide purge flow and auto zeroing of the flow sensor pressure transducer.

AVea

Chapter 3 Installation Instructions

This chapter provides instructions for installing the AVEA ventilator systems.

Stand Assembly

Standard Cart Assembly Instructions (P/N 15986)

Standard stand carton contents

QUANTITY	DESCRIPTION
10 each	5/16” screws
10 each	5/16 “ lock washers
2 each	5/16-18” hex nuts
1 each	Drag chain and modified washer
2 each	Flat washers for pole
1 each	7/16 tube bracelet
1 each	Top plate assembly
2 pieces	Stand Posts
1 each	Pedestal base
4 each	End caps
4 each	Casters (2 with brake, 2 without brake)

Tools required

1/2“ open end socket

3/16” Allen wrench or driver

1. Remove the contents of carton.
2. Attach the base to the pedestal using the 5/16” screws, washers and nuts as shown in Figure 3.1. The anti-static drag chain may be attached to either screw.
3. Attach the pole to the assembly using the 5/16” screws and washers (refer to Figure 3.1).

4. Attach the top plate to the pedestal using the 5/16” screws and washers (refer to Figure 3.1).

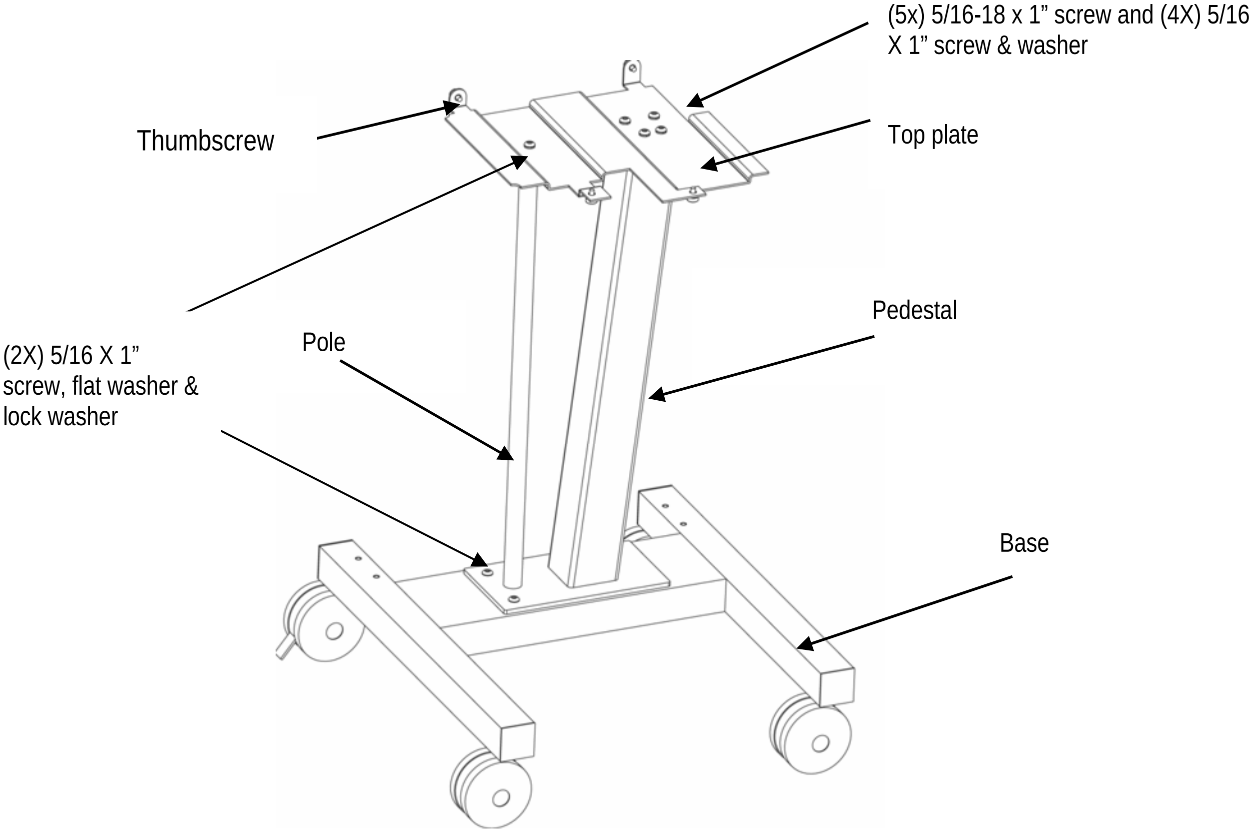

(5x) 5/16-18 x 1” screw and (4X) 5/16 X 1” screw & washer
Thumbscrew
Top plate
Pedestal
Pole
(2X) 5/16 X 1” screw, flat washer & lock washer
Base

Figure 3-1 Assembling the Stand

5. Place AVEA Ventilator on top plate, align thumbscrews (4) and lightly start all thumbscrews to locate AVEA Ventilator (refer to figure 3.2). Fully tighten (4) thumbscrews to secure AVEA Ventilator.

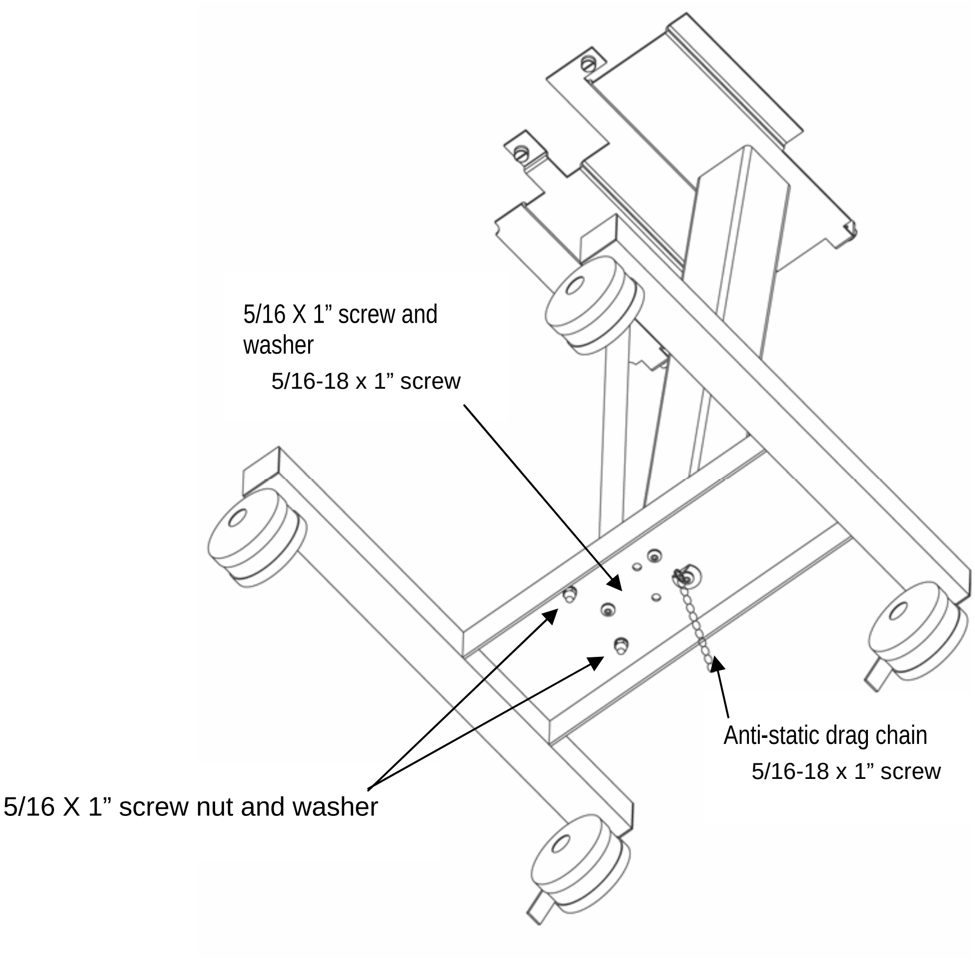

5/16 X 1" screw and washer
5/16-18 x 1" screw
Anti-static drag chain
5/16-18 x 1" screw
5/16 X 1" screw nut and washer

Figure 3-2 Bottom of stand

Comprehensive Assembly Instructions

Refers to P/N 33976

1. Open main carton.
2. Remove the center carton that contains the pedestal, hardware and instructions and open.
3. Remove second carton that contains top plate/pole and set aside.
4. Remove the 4-legged base assembly from carton and set base on the floor as shown in Figure 3-3. Place pedestal onto the base assembly as show in Figure 3-3.

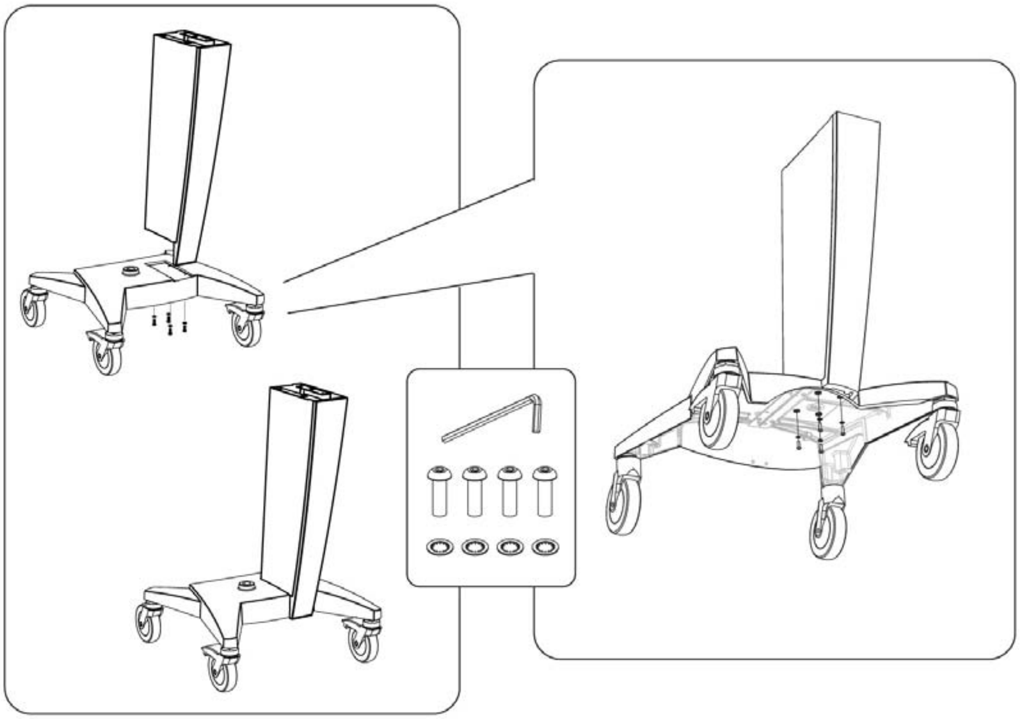


Figure 3-3

5. Using the 1/8” Allen wrench provided install and secure the 4 10/24” x ¾” screws along with the 4 star washers.

6. Install collar set screw using the 1/8" Allen as shown in Figure 3-4. Next remove pole from Top Plate carton install and secure the 1" pole using the collar set screw as shown in Figure 3-4.

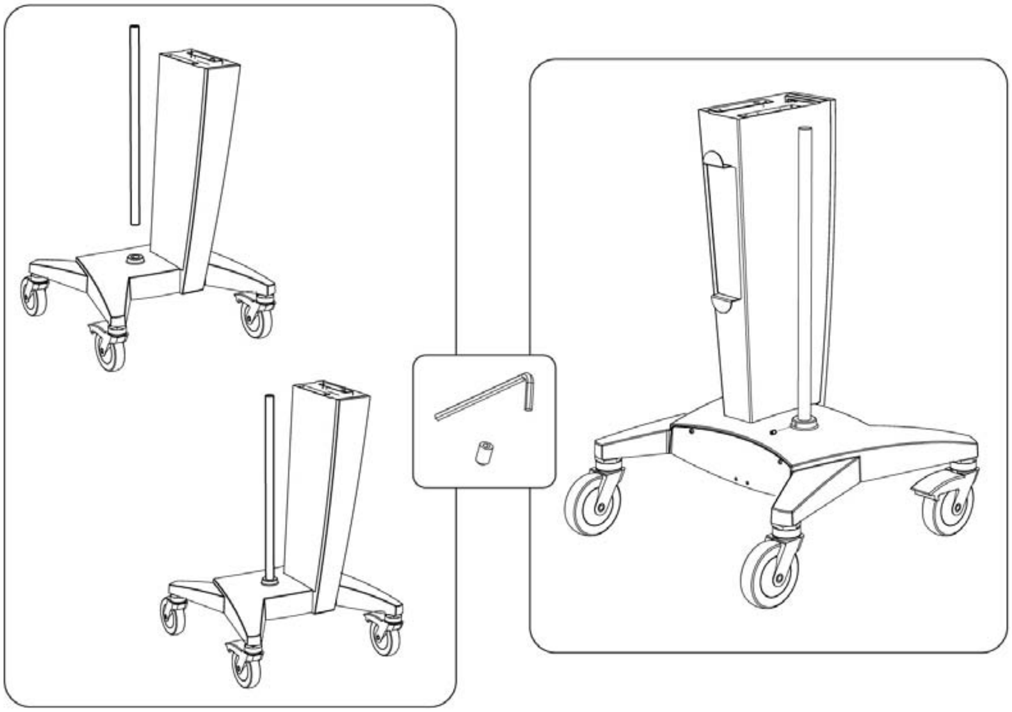


Figure 3-4

7. Remove Top Plate and set Top Plate onto the pedestal and pole as shown in Figure 3-5. Using the 3/32" Allen wrench provided install and secure the 4 counter sink screws as shown in Figure 3-5.

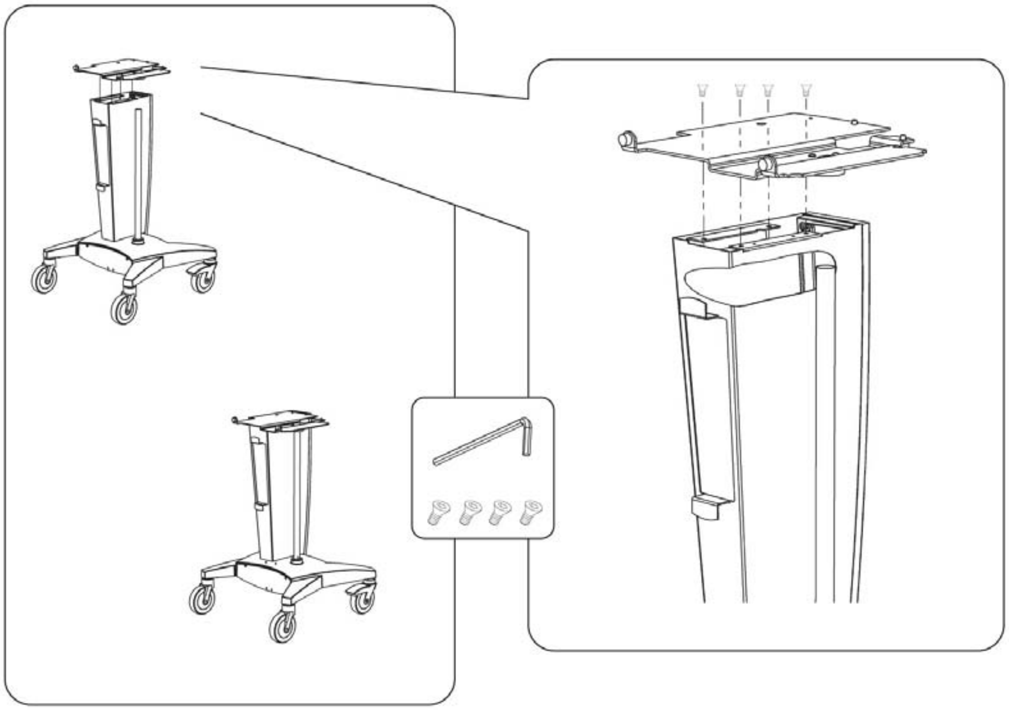


Figure 3-5

8. Using the 1/8” Allen secure the setscrew of the upper collar into the 1” pole as shown in Figure 3-6.

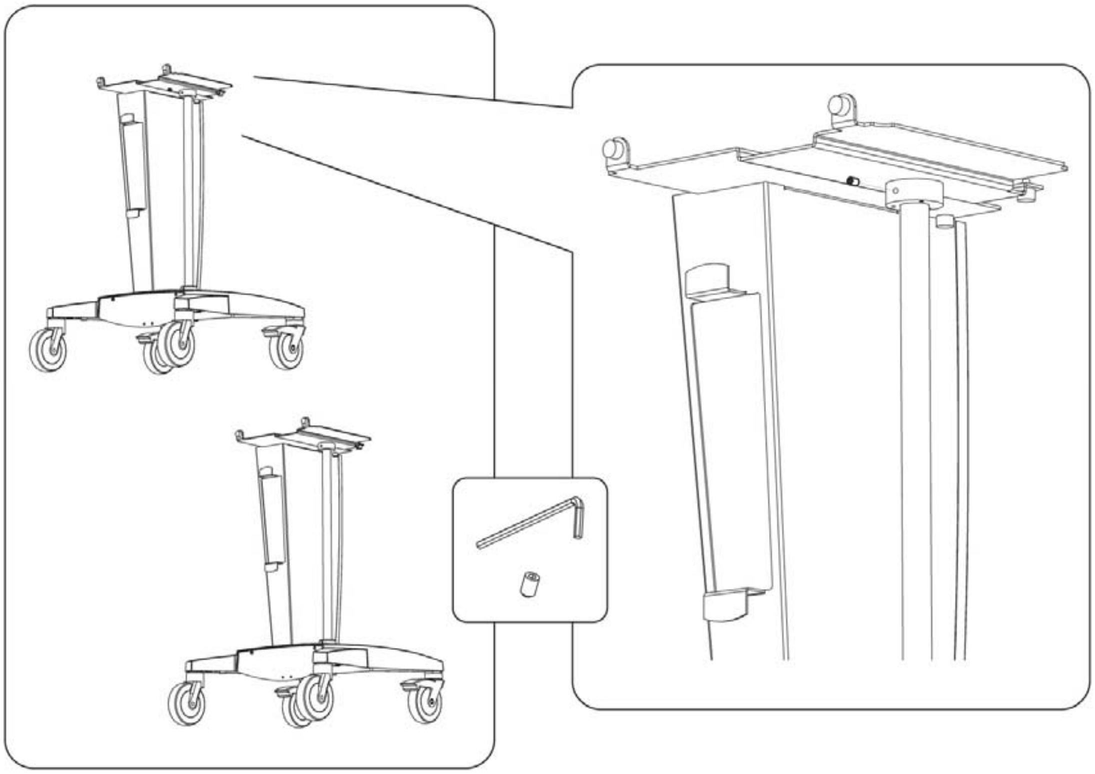


Figure 3-6

Note

If installing external battery pack, proceed to the next section.

9. Place AVEA Ventilator on top plate, align thumbscrews (4) and lightly start all thumbscrews to locate AVEA Ventilator. Fully tighten (4) thumbscrews to secure AVEA Ventilator.

Customer Transport Cart Kit P/N 11372

Note: Before installation, verify that the following parts are in your kit:

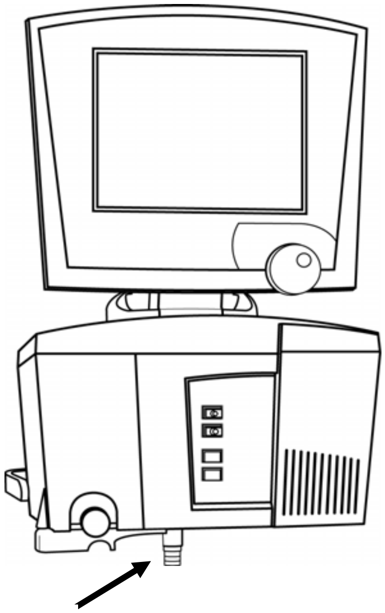
Description	Quantity	Part Number
12V lead acid battery	2	16179
Battery tray, screw (10/32 x 5/16) X2, washer #10 X 2 & nut 10/32 KEPS		33977
Wire harness	1	16217
Literature	1	L2285
Rack Tank Cart Assembly	1	33978

If any parts are missing contact VIASYS AVEA Customer Service at

800-325-0082 or 760-883-7185.

External Battery Installation

1. Unscrew the (4) thumbscrews securing the base to the ventilator body as shown. Lift the ventilator body and UIM from the wheeled base.
2. Gently set the ventilator down on a secure flat surface (see note on following page).
3. If attached, remove the Gas Tank holder from the base.

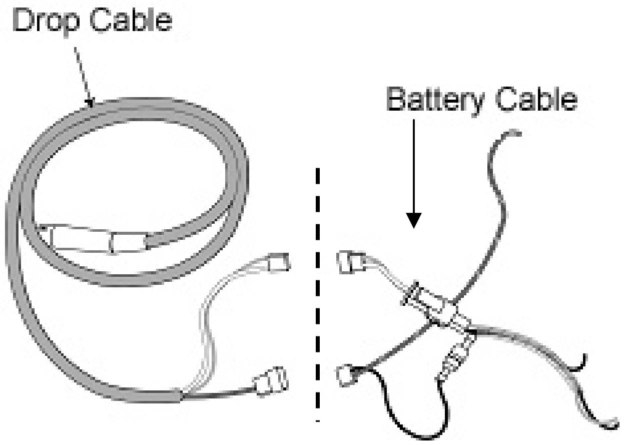


Patient Breathing
Gas Outlet

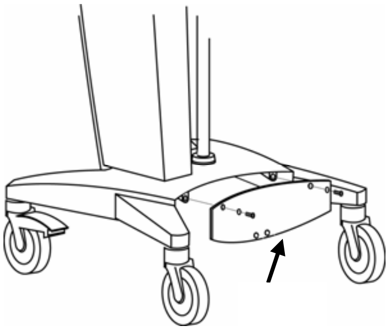
Note

Do not rest the ventilator on the patient breathing gas outlet. Resting the weight of the ventilator on this outlet may cause damage resulting in leaks at the site.

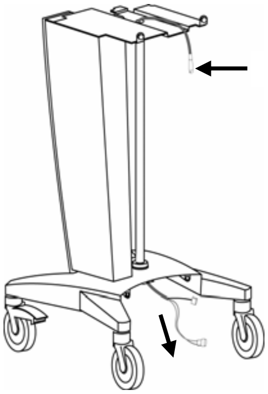
4. Detach the drop-cable portion from the main battery harness as shown.



5. Remove the two screws holding the face plate between the rear wheels of the AVEA cart and detach the faceplate.



6. Thread cable harness through the cart pole.



CAUTION

After the cable has been threaded, inspect the cable for any cuts, abrasions or scaring.

7 Place the two batteries into the tray as shown in Photo 1.

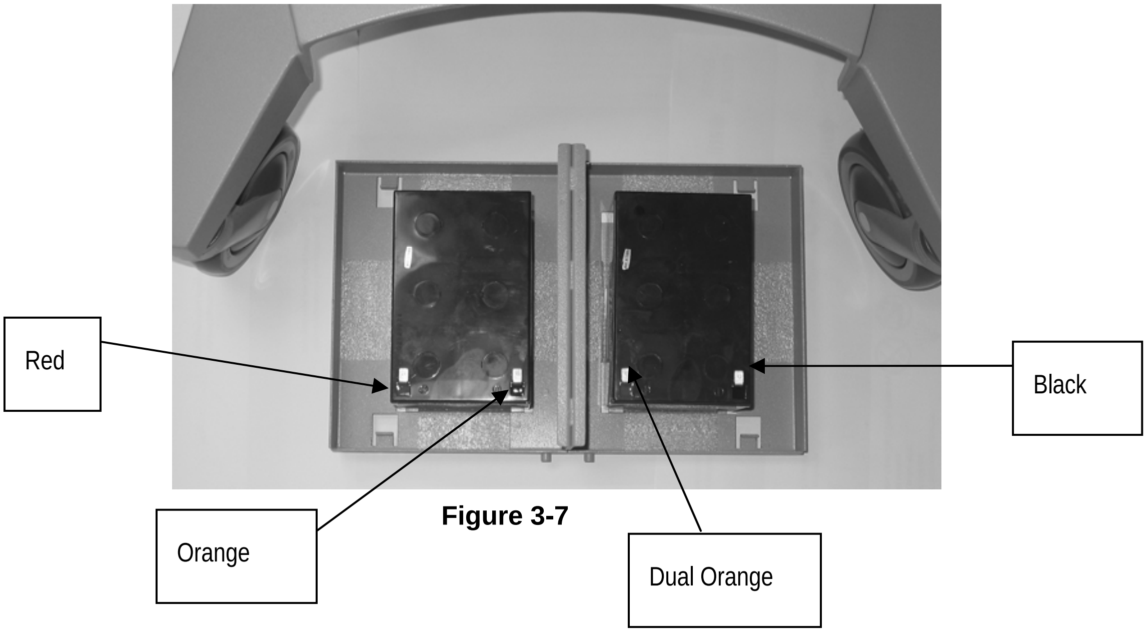

Red
Black
Orange
Dual Orange

Figure 3-7

8. Attach harness (P/N 16217) to batteries:

- Connect black wire to negative post (black) on the outer right hand side battery
- Connect the dual orange wire to positive post (red) on the inner right hand side battery
- Feed the single orange and single red wires through the center battery support bracket opening to the left hand side battery area
- Connect the single orange wire to the negative post (black) on the left hand side battery
- Connect the single red wire (positive) to the positive post (red) on left hand side battery

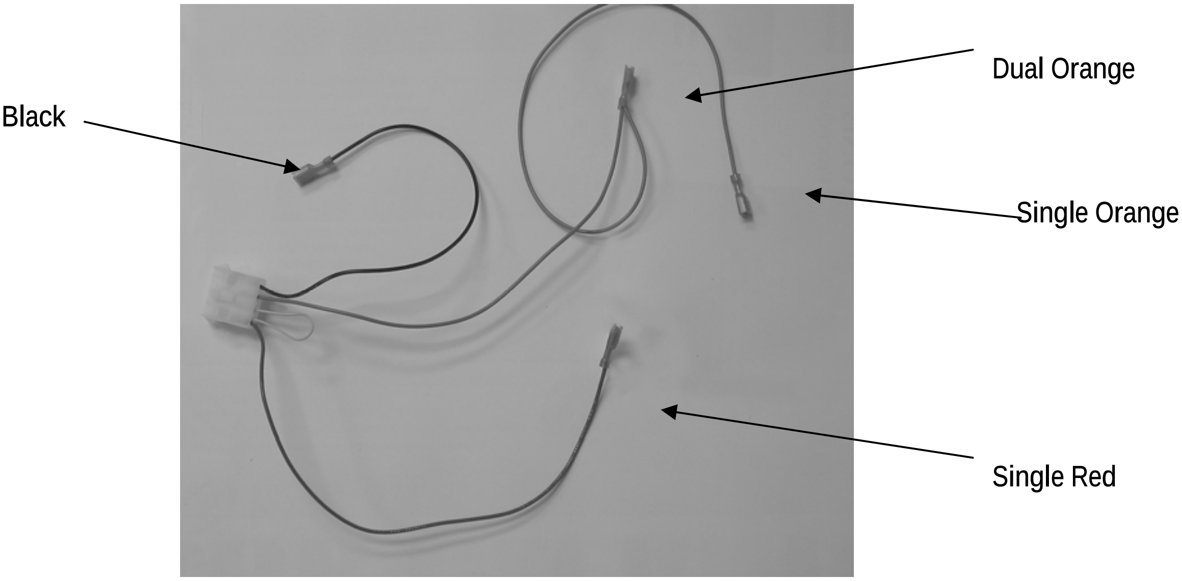

Dual Orange
Black
Single Orange
Single Red

Figure 3-8

9. Attach monitor PC board (P/N 16105) and wiring:
    - Connect 4 pin male Molex™ to the 4 pin female Molex from the battery harness

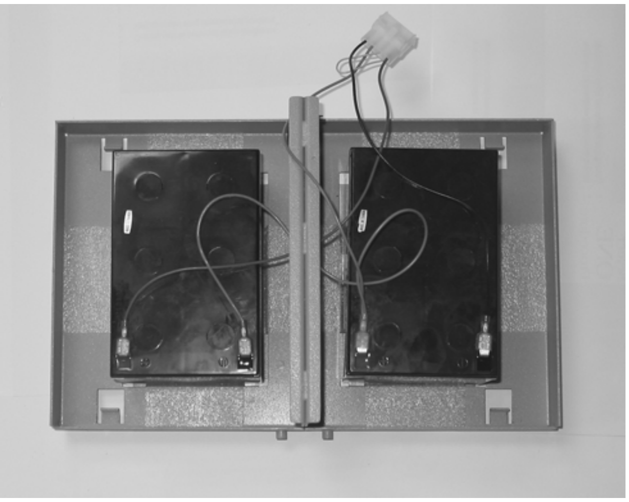
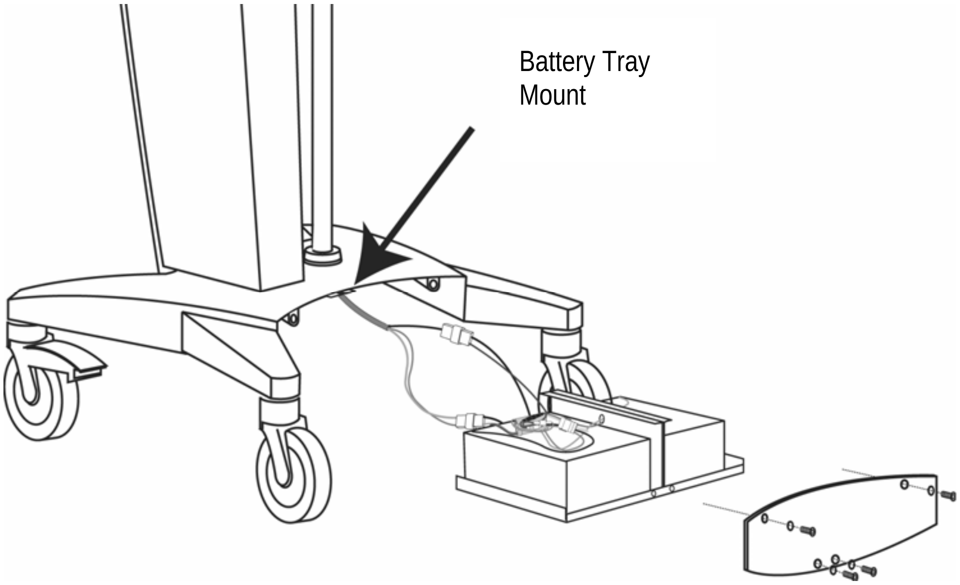


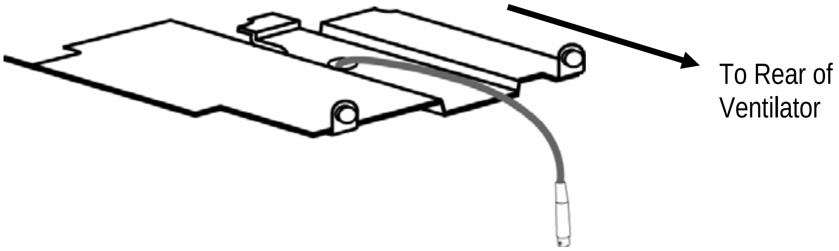
Figure 3-9

10. Slowly slide the completed battery and tray assembly onto the mount beneath the AVEA stand making sure that no wires are kinked or scuffed during assembly. Maintain tension on drop cable from top of cart to prevent kinking at battery tray. Sufficient cable slack must be available at top of cart to make connection at back of ventilator.

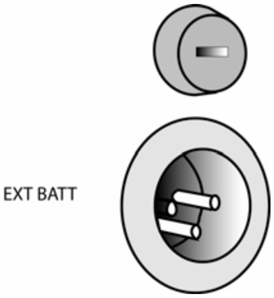


11. Attach the faceplate removed earlier in the instructions to the bottom of the battery tray with the hardware supplied.

12. Re-attach the ventilator body to the stand making sure the external battery cable lays untwisted in the cable slot and emerges at the rear of the ventilator.



13. Connect the external battery cable to the connection labeled EXT BATT on the rear panel of the AVEA.



14 Plug the AVEA into a grounded AC outlet and apply power to the ventilator.

15. Check that the battery status display on the front panel indicates that the ventilator is connected to External battery power.

Note

The battery status will indicate red immediately after the external batteries are connected and the unit is powered up. If the batteries are fully charged, the battery status should indicate green (charged) within one hour of connection. If the batteries are not fully charged, it may take up to 48 hours to indicate green. Refer to your operator's manual for recommended battery charging.

"E" Cylinder Bracket Assembly Instructions

This assembly (P/N 33978) is part of kit, P/N 11372.

Quantity	Description
1 each	Saddle
1 each	Center post with Velcro cylinder straps
2 each	1/4"-20 counter-sink allen-head screws
4 each	1/4"-20 round-head allen screws
4 each	Lock washers

Tools Required for Assembly

1 each 5/32" hex wrench/driver

1 each drill with 17/64" bit

1 each ruler

1 each center punch

Standard Stand Tank Rack Bracket Installation

Basic Stand Tank Rack Bracket Installation

1. Install the center post in the tank bracket using two flathead 1/4"-20 thread screws to secure. (Figure 3.10)

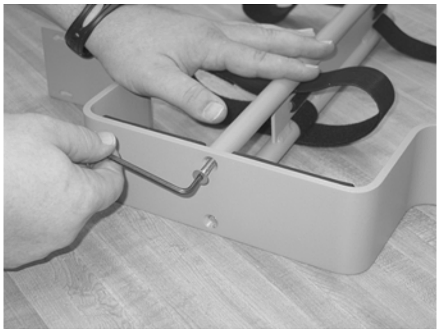


Figure 3-10 Basic Stand Assembly

Place assembled tank bracket on short side of “H” stand legs. (Figure 3.11)

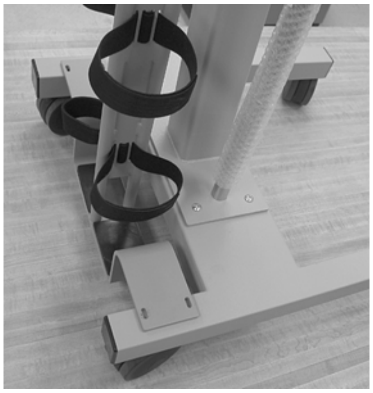


Figure 3-11 Tank brackets

NOTE

If there are pre-drilled holes on the “H” stand, skip to Step 8.

2. Place tape measure under bracket. Slide bracket back 3/4” from the edge of the “H” cross piece. (Figure 3.12)

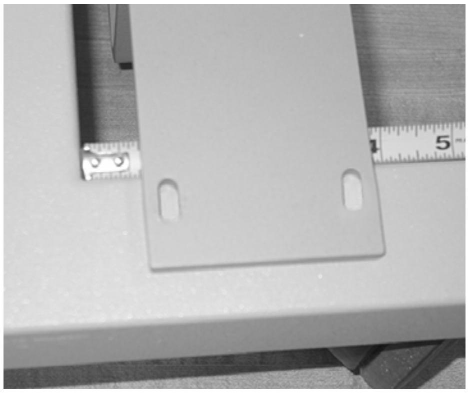


Figure 3-12 Plate

3. Center the bracket on the two legs of the “H”. The bracket should be positioned approximately 11/16” from the outside edge of each leg. Recheck the initial 3/4” dimension measurement (refer to Figure 3.13).

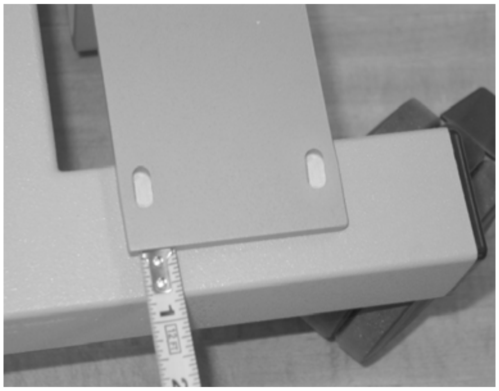


Figure 3-13 Plate Placement

4. Using a pencil, mark location of tank bracket in center of slotted holes on the bracket. (Figure 3.14).

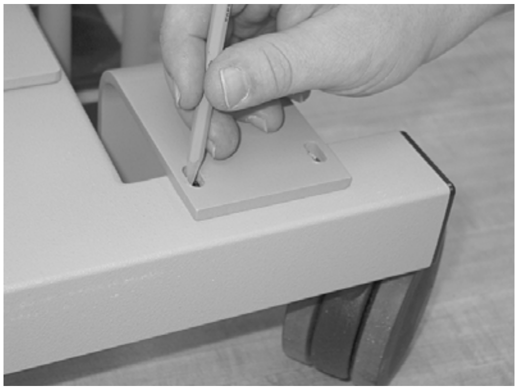


Figure 3-14 Hole pattern

5. Center punch-marked locations. Before drilling, move rear wheels out of the way to prevent damage. (Figure 3.15).

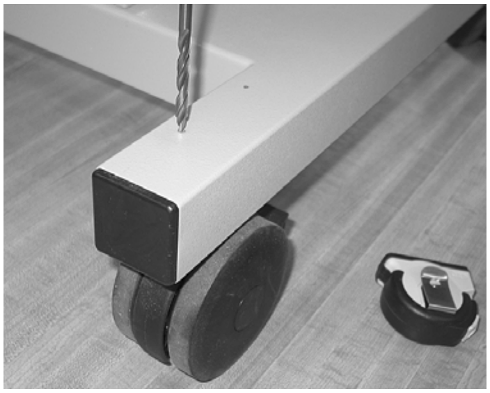


Figure 3-15 Wheel alignment

6. Using 17/64” (.265) drill bit, drill through both bracket walls. (Figure 3.16)

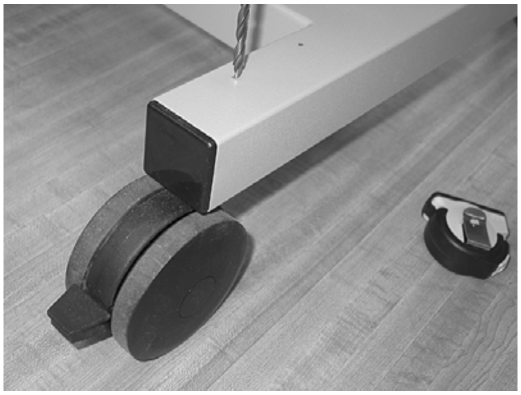


Figure 3-16 Drill position

7. Remove burrs from drilled holes and insert screw from bottom, guiding through both holes in tubing and tank bracket. (Figure 3.17)

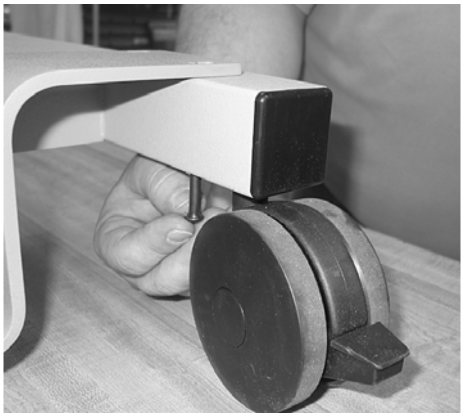


Figure 3-17 Deburring

8. Place washer (x4) and nuts (x4) over screws and tighten securely.

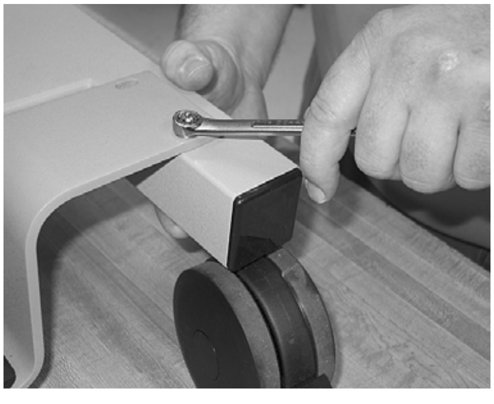


Figure 3-18 Tighten

Assembly Instructions for Comprehensive Cart Tank Rack Bracket

Place the comprehensive stand on a flat surface with the rear of the stand facing up.

Align the saddle with the 4 stand mounting holes as shown in the photos below (Photo 1 and 2).

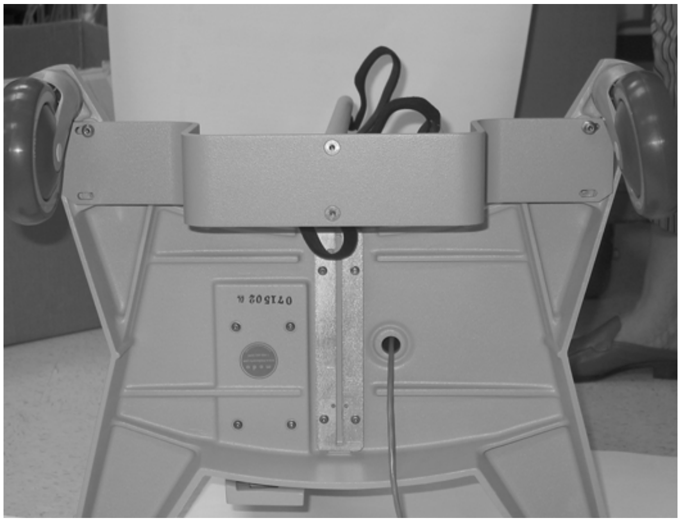


Figure 3-19 Photo 1

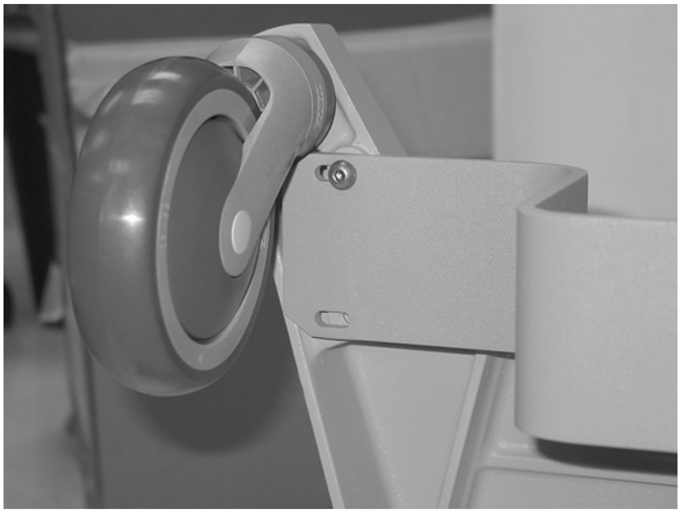


Figure 3-20 Photo 2

With the 5/32 Allen wrench, install and secure the 4 screws and lock washers to attach the saddle to the stand.

CAUTION

Ensure that the saddle is in no way touching the wheels/casters of the stand.

AVEA Unpacking Instructions

Introduction

The AVEA is packaged in two parts for safe shipping. A small amount of assembly is required. All literature and instructions to enable you to safely assemble, set up and check your AVEA are included in the box with your ventilator.

Unpacking

CAUTION

The AVEA shipping container is designed to be moved or positioned by a forklift or pallet jack only. Do not attempt to lift or manipulate the container manually as damage or injury could result.

Note

The AVEA Cart shipped with your ventilator must be assembled first. To reduce the risk of damaging the ventilator, make sure the cart is ready before you unpack the instrument.

Note

Your Operator's Manual and other important literature are packed beneath the AVEA. Do not discard!

1. Remove all outer securing straps by cutting them. Discard.
2. Open the box and remove the top layer of packaging material. (Figure 3.21)

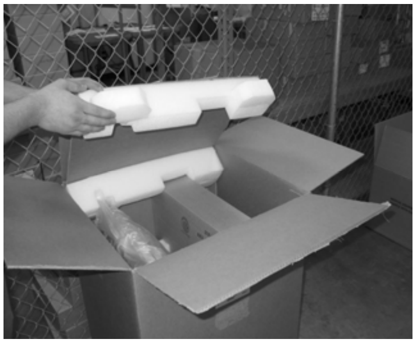


Figure 3-21 Box Opening

3. Remove the AVEA accessory box. Place it on a secure surface. (Figure 3.22)

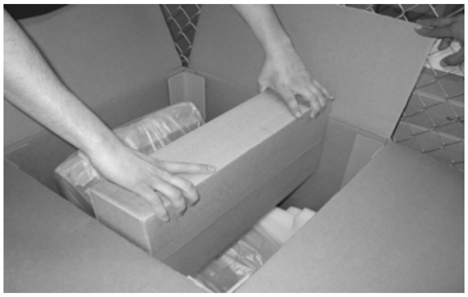


Figure 3-22 Accessory box removal

4. To remove the cardboard cover, lift the box straight up. Do not pull or tilt the cover until you are sure it has cleared the ventilator.
5. Remove the protective packaging from the sides of the ventilator and carefully remove the plastic. (Fig. 3.23)

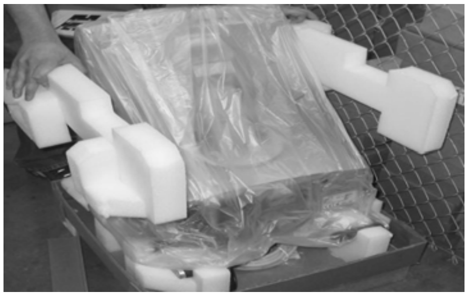


Figure 3-23 Protective packaging

6. Apply the brakes on the cart that has been previously assembled by pressing down on the foot pedals. (Fig. 3.24)

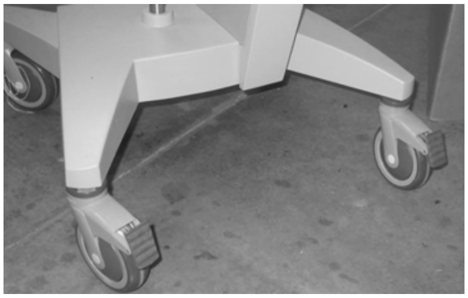


Figure 3-24 Brakes

7. With assistance, lift the AVEA from the box and carefully position the unit on the top plate assembly of the cart. Secure the unit using the 4 thumbscrews. (Figure 3.25)

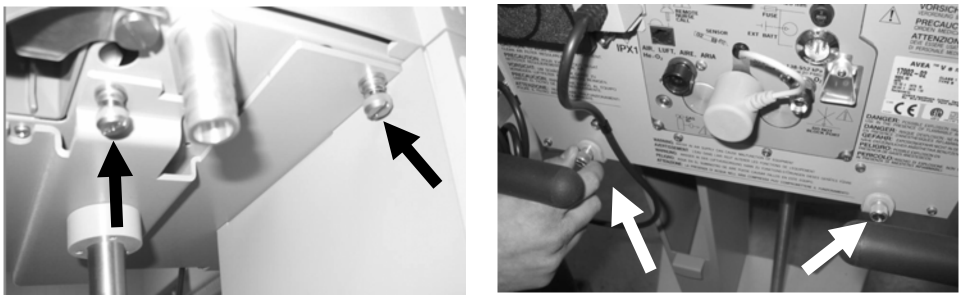


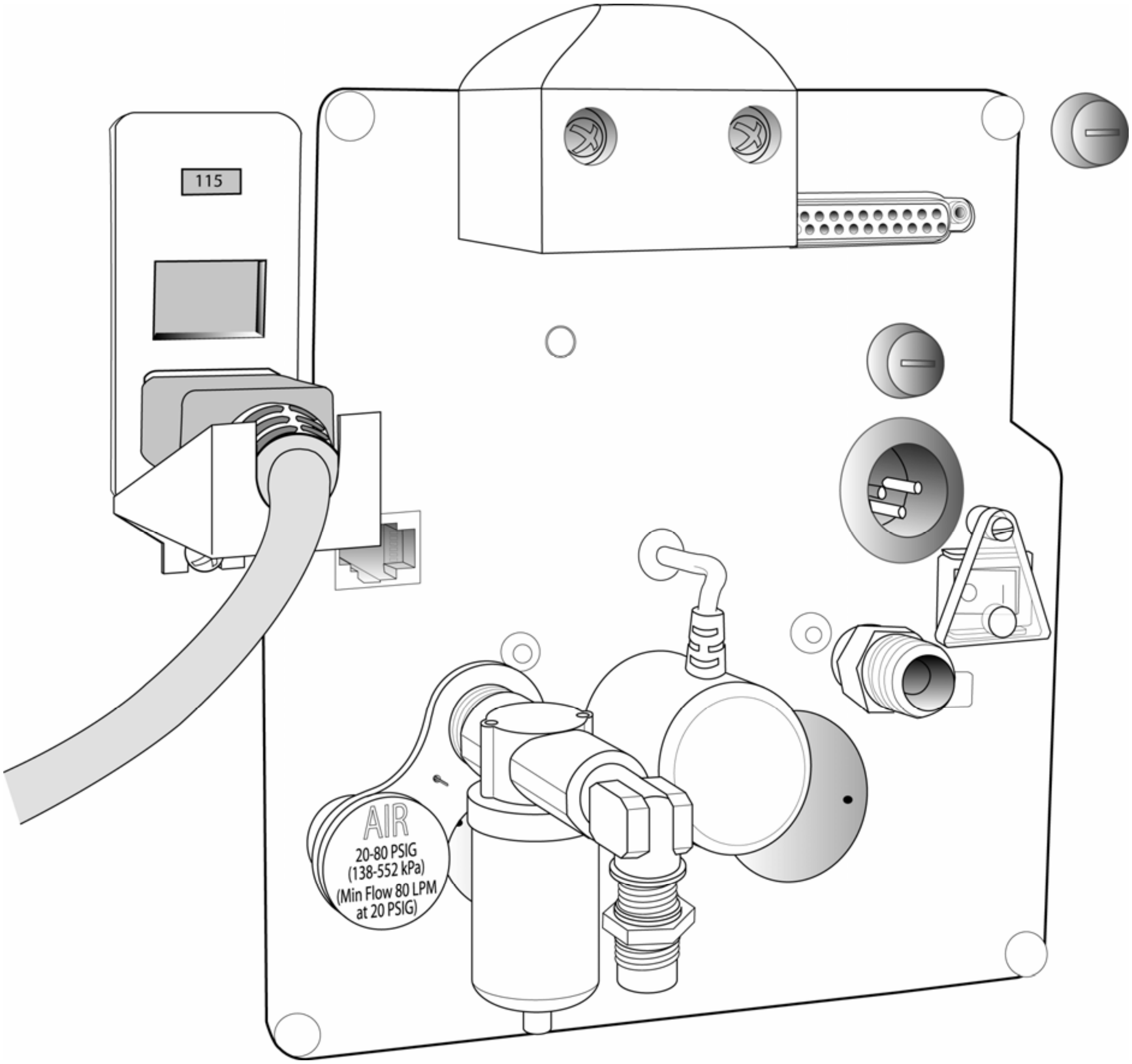
Figure 3-25 Thumbscrew Positions

Note

Make sure the external battery cable lays untwisted in the cable slot and emerges at the rear of the ventilator (if applicable)

8. Loosely secure the 2 thumbscrews in the back of the ventilator, followed by the 2 thumbscrews on the bottom front of the unit. Tighten all 4 screws.

SETTING UP THE REAR OF THE VENTILATOR



Medical Gas Connector Kit Installation Instructions

Air "Smart" Connector Installation Instructions (P/N 51000-40897 DISS)

Note

If you have not ordered the Heliox option, you will receive only the Air smart connector and the appropriate air hose for your configuration. The Air connector comes pre-assembled with the integral water trap/filter as shown in figure 1. It attaches to the fitting located to the left of the Oxygen cell on the rear panel of the AVEA.

> **CAUTION**
>
> Always consult your Operators Manual for instructions and clinical recommendations concerning the use of AVEA accessories.

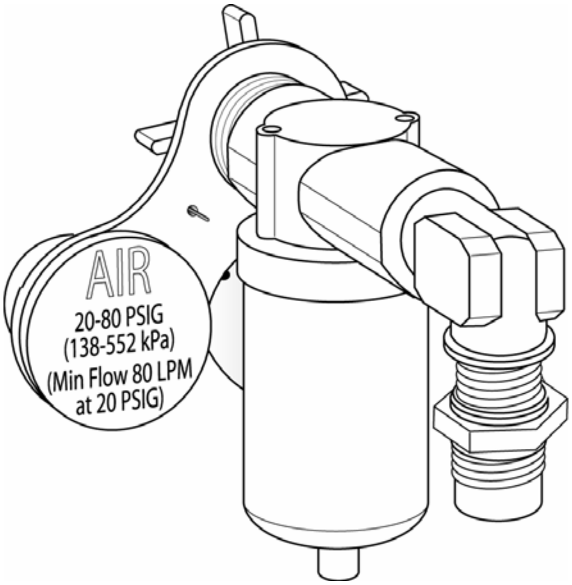

AIR
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

Figure 3-26

1. Carefully align and seat the ‘smart’ connector pin and the gas fitting.

2. Tighten the threaded collar on the AVEA onto the male gas fitting of the “smart’ connector assembly. (Fig. 3.27)

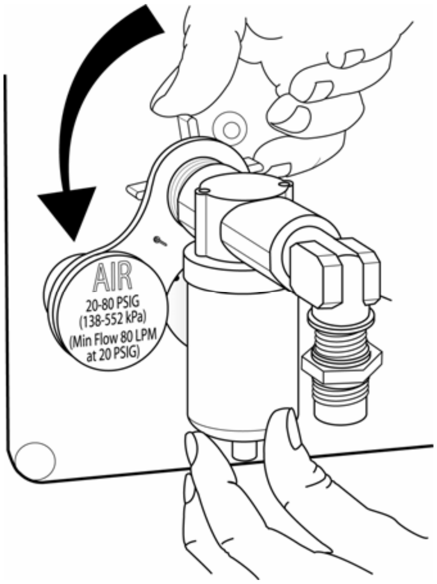

AIR
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

Figure 3-27

Attach the Air hose appropriate for your gas configuration. (Fig. 3.28) (Female DISS fitting is shown here).

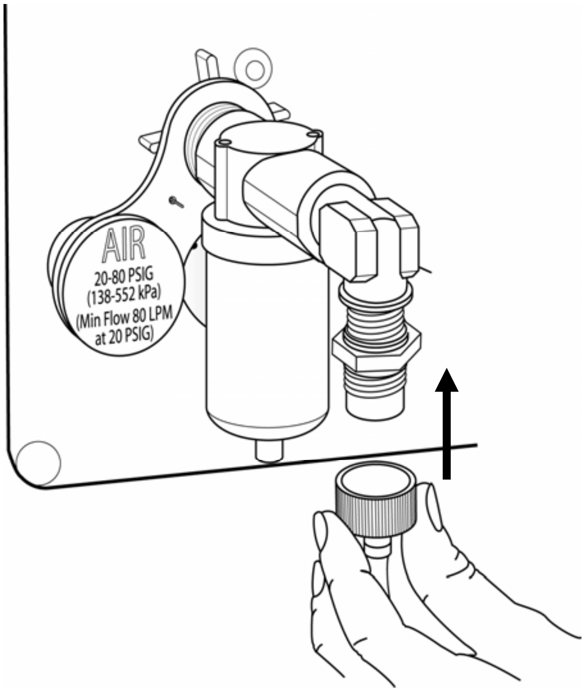

AIR
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

Figure 3-28

Air and Heliox Tethered “Smart” Connector Installation Instructions

(Domestic/ DISS P/N 16131 / International / NIST P/N 16132)

WARNING

Connection of a gas supply at the Helium-Oxygen mixture inlet that does not contain 20% oxygen can cause hypoxia or death.

Although an 80/20 mixture of Helium and Oxygen is marketed as medical grade gas, the Helium/Oxygen gas mixture is not labeled for any specific medical use.

Note

The Heliox “smart” connector comes already tethered to the Air assembly and the “smart” connector attachment bracket as shown in figure 3.29.

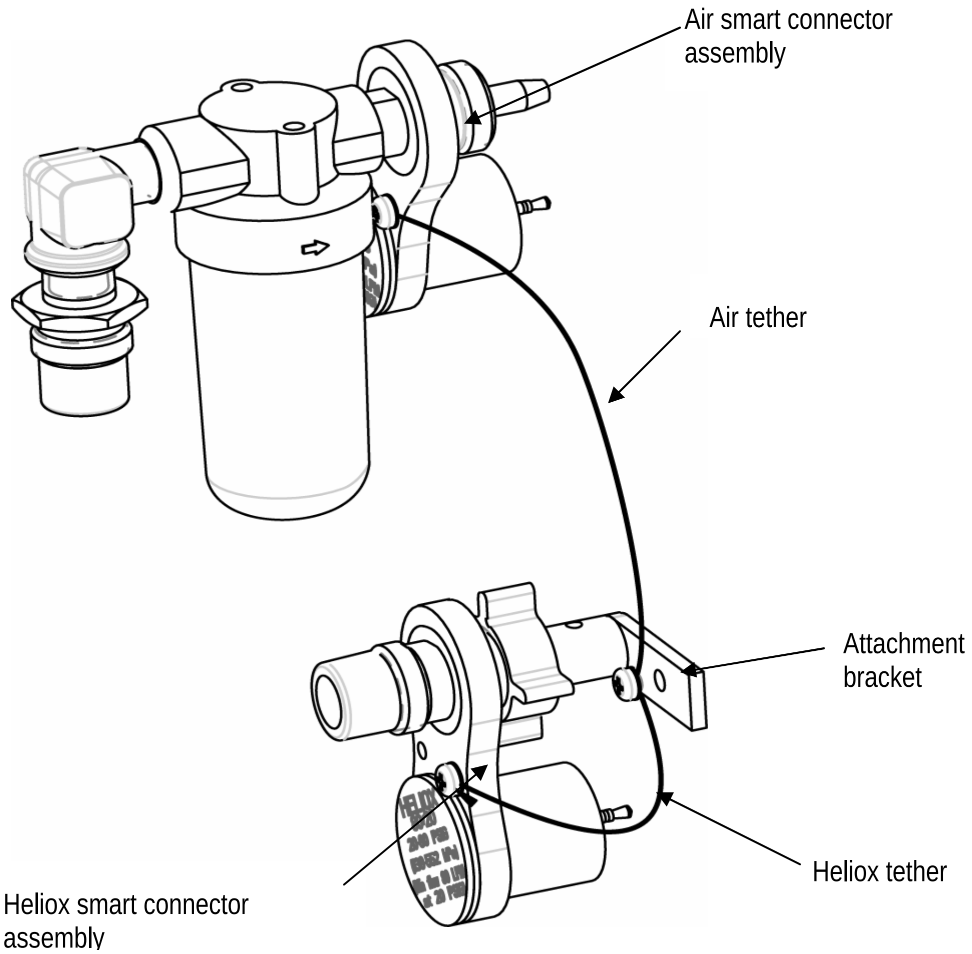
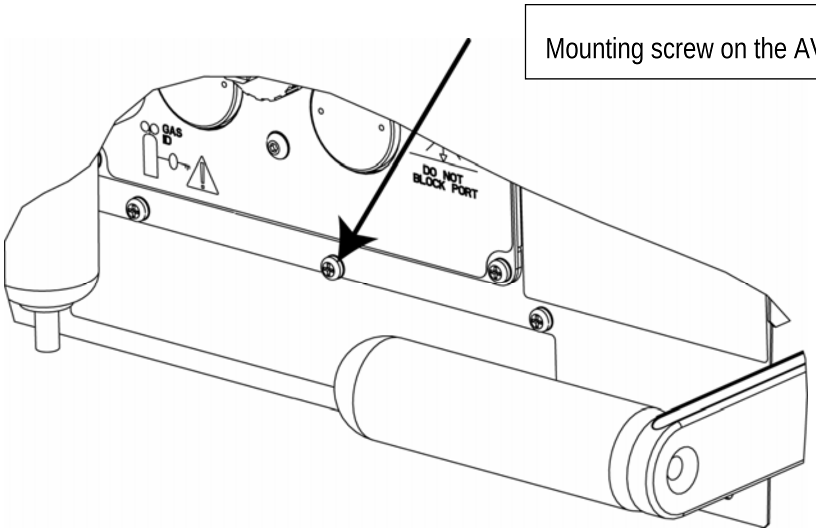

Air smart connector assembly
Air tether
Attachment bracket
Heliox tether
Heliox smart connector assembly

Figure 3-29

Note

The Heliox "smart" connector is designed for use with an 80/20 Heliox tank only. Only a mixture of 20% oxygen and 80% Helium can be used as the Heliox gas supply.

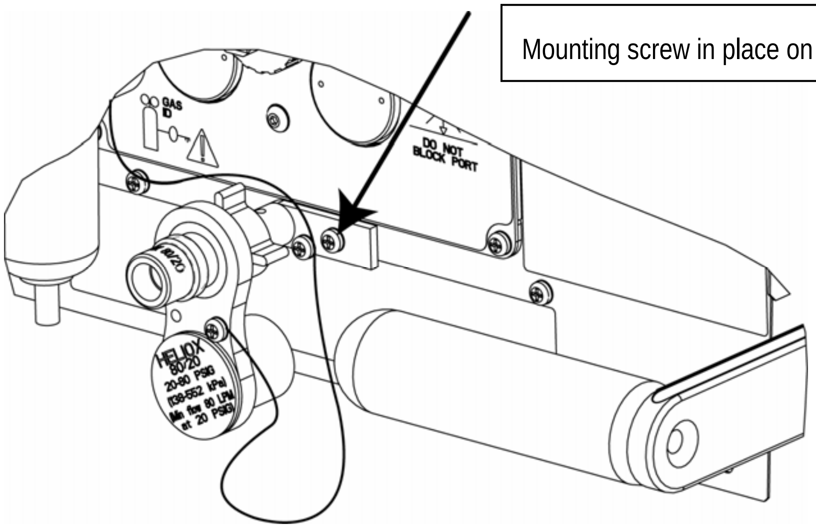
1. To assemble the Air/Heliox assembly, first attach the Air "smart" connector/water trap assembly to the AVEA rear panel fitting as described in the "Air connector only installation instructions" section.
2. After attaching the Air connector, remove the Philips screw from the rear of the AVEA. (Figure 3.30)


GAS
ID
DO NOT
BLOCK PORT

Mounting screw on the AVEA

Figure 3-30

3. Insert the screw provided in the kit through the mount on the tethered Heliox Smart connector holder. (Fig. 3.31)


GAS
ID
DO NOT
BLOCK PORT
80/20
HELIOX
80/20
20-80 PSIG
(138-552 kPa)
Min flow 80 LPM
at 20 PSIG

Mounting screw in place on the AVEA

Figure 3-31

Heliox “Smart” Connector Installation Instructions (DISS P/N 51000-40918)

Note

The Heliox “smart” connector is designed for use with an 80/20 Heliox tank only. Only a mixture of 20% oxygen and 80% Helium can be used as the Heliox gas supply. To use the Heliox “smart” connector you must turn off the air gas supply and unscrew and detach the Air hose from the air smart connector.

CAUTION

The air “smart” connector and water trap are removed as one unit. Do not attempt to separate them as you may damage the assembly.

Note

Heliox 15’ hose is P/N 50000-40042.

1. To remove the Air “smart connector and water trap, support the assembly with one hand and loosen the attachment collar. (Figure 3.32)

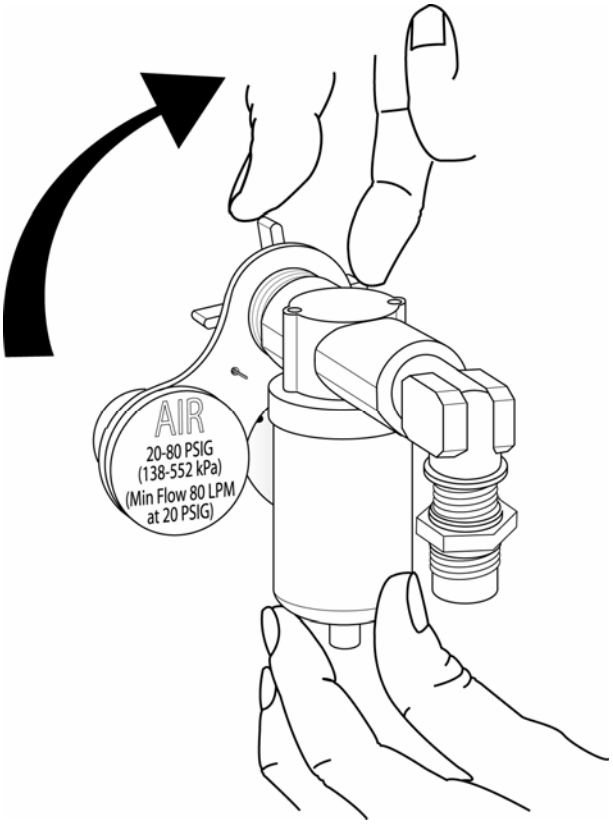


Figure 3-32

2. While still supporting the air connector, loosen the collar of the tethered Heliox Connector and detach it from its storage bracket. (Figure 3.33)

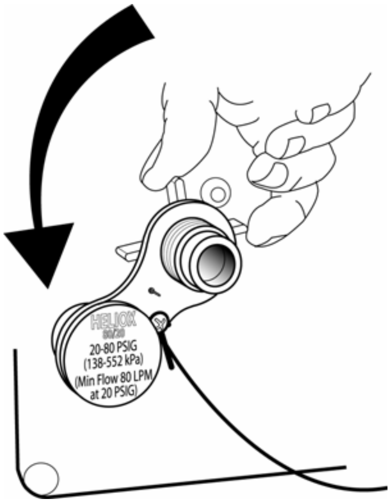


Figure 3-33

3. Position the Air connector onto the same support bracket and tighten down the collar until the air connecter and water trap are **fully secured** to the storage bracket.

CAUTION

Make sure that neither the air nor the Heliox tether gets caught in the support collar while you are tightening it down. If either tether fouls the threads of the collar, the Air connector assembly may not be adequately secured to the bracket.

Note

Please note that a DISS fitting may be required in addition to those included. These may be obtained from Superior Products in Cleveland, Ohio (216) 651-9400 P/N MA692.or your gas fittings supplier of choice.

4. Align the Heliox smart connector with the Smart connector receptacle on the left side of the AVEA back panel from which you removed the Air connector. Tighten down the collar of the gas port onto the Heliox fitting. (Figure 3.34)

5. The HeO2 cylinder symbol should appear in the lower right hand corner of the user interface screen.

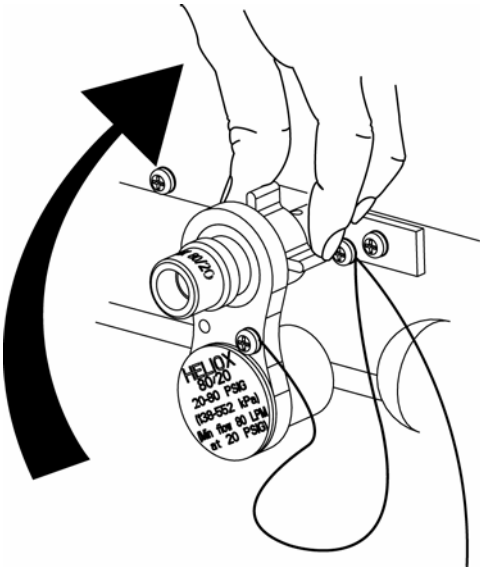
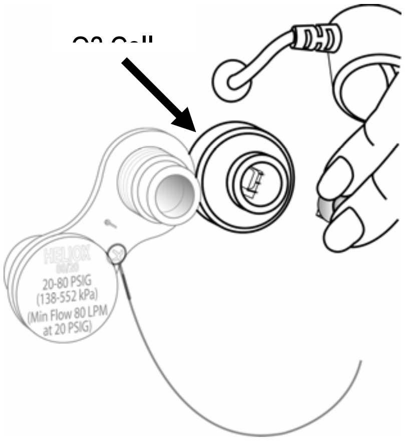

80/20
HELIOX
80/20
20-80 PSIG
(138-552 kPa)
Min flow 80 LPM
at 20 PSIG)

Figure 3-34

Connecting the Oxygen Sensor P/N 68289


O2 Cell
HELIOX
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

The oxygen sensor cell is located on the rear panel, between the two gas fittings. The oxygen sensor cable emerges from the rear panel directly above the sensor. Carefully align and then gently push the connector onto the oxygen sensor until it seats. When a good connection has been made, slide the protective cover down and push over the sensor.

Figure 3-35 Connecting the O2 Sensor

Attaching the Gas Hoses

Oxygen Connection

Attach the Oxygen hose to the fitting on the right of the back panel (see figure 3-36).

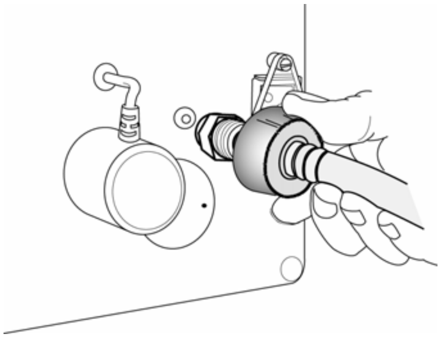
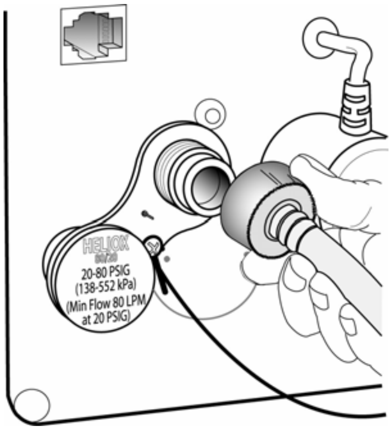


Figure 3-36 Connecting the O2 Hose

Heliox Connection


HELIOX
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

If you have the upgrade for Heliox delivery, attach the Heliox hose .to the tethered “Smart” connector fitting on the left of the back panel as shown in figure 3-37.

The air hose will not attach to the fitting designed for Heliox and vice versa.

Figure 3-37 Connecting the Heliox Hose

WARNING

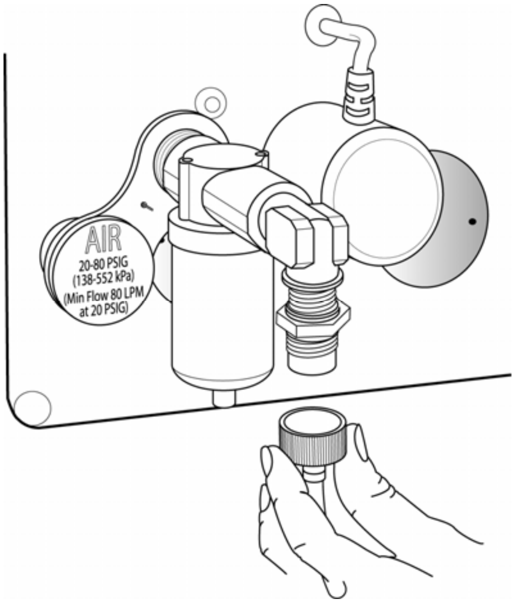
Allow 90 seconds for the accumulator to purge before initiating patient ventilation with Heliox gas.

WARNING

Connection of a gas supply at the Helium-Oxygen mixture inlet that does not contain 20% oxygen can cause hypoxia or death.

Although an 80/20 mixture of Helium and Oxygen is marketed as medical grade gas, the Helium/Oxygen gas mixture is not labeled for any specific medical use.

Attaching the Air Hose



Attach the Air supply hose to the “Smart” connector fitting with the integral water trap/filter on the left of the back panel as shown in figure 3-38.

The fitting shown here is a DISS fitting. Fittings which accept NIST and Air Liquide hoses are also available from VIASYS.

The air hose will not attach to the fitting designed for Heliox and vice versa.

Figure 3-38 Attaching the Air Hose to the water trap/filter

Note

The fitting for Air will not accept a Heliox connection and vice versa.

Chapter 4 Assembly and Disassembly

General Instructions and Warnings

The removal and installation of major subassemblies requires OVP and possibly calibration. Refer to chapters 5 and 7 for instructions.

When disassembling or assembling the AVEA, refer to the tubing diagram, P/N 51000-40841, the wiring diagram P/N 51000-40839 and appropriate schematics and assembly drawings located in Appendix B of this manual. The illustrations shown here are for reference only, current revisions of these diagrams and schematics are available to qualified personnel from VIASYS Healthcare, Critical Care Division, Technical Support.

WARNING

Always take standard ESD precautions when working on AVEA ventilator systems.

Assume that you are adequately earth grounded prior to handling and working inside of the AVEA ventilator.

Ensure the ventilator is disconnected from the AC power supply before performing repairs or maintenance. When you remove any of the ventilator covers or panels, disconnect the internal battery “quick release” connector (see figure 3.1) before working on the ventilator. If the ventilator has an external battery installed, ensure that the external battery is unplugged from the rear panel before proceeding.

Recommended Tools & Equipment

Note

Before using any test equipment [electronic or pneumatic] for calibration procedures, the accuracy of the instruments must be verified by a testing laboratory. The laboratory master test instruments must be traceable to the NIST (National Institute of Standards Technology) or equivalent. When variances exist between the indicated and actual values, the calibration curves [provided for each instrument by the testing laboratory] must be used to establish the actual correct values. This certification procedure should be performed at least once every six months. More frequent certification may be required based on usage.

Long & short Philips screwdrivers	
Flat bladed screwdriver	
7/8” Nut Driver	
11/32” Nut Driver	
Digital Volt Meter	
Adult test Lung (Siemens)	P/N 33754
Adult Patient Circuit (72”)	P/N 16045
Infant test lung	P/N 34057
Infant Patient Circuit	
Pediatric Patient Circuit	
Oxygen Analyzer	

Rubber Stopper
Stop Watch
Side cutters

User Interface Module (UIM) P/N 16259 Domestic (P/N 16260 International)

Removal

1. Remove the ‘rubber collar’ located at the UIM rear neck, by grasping one of the two rubber tabs at the bottom. Pull firmly in an “arcing” motion.
2. Remove (1) Phillips screw from the ‘front arm cover’ located below the UIM. Remove the ‘front arm cover’.
3. Remove the two mounting screws now visible inside the ‘back arm cover’. Tilt the UIM down and remove the ‘back arm cover’.
4. Remove the exhalation filter from the filter well. Using a long Phillips screwdriver, remove the (1) Phillips screw located at the top of the exhalation filter assembly well.
5. Remove the (1) Phillips screw located at the exhalation port marked EXH.
6. Remove the (4) 11/32 KEP nuts that secure the ‘plastic top cover’ opening onto the chassis.
7. Remove (2) Phillips screws that secure the ‘plastic top cover’ to the rear chassis.
8. Slide the top ‘plastic top cover’ forward and upward away from the chassis.
9. Remove the (2) Phillips screws and washers that secure the ‘UIM interface cable connector’ on the rear chassis. Unplug the ‘UIM interface cable connector’.
10. Carefully pull the ‘UIM interface cable connector’ through the ‘plastic top cover’ opening.
11. While continuously supporting the UIM, remove (4) nuts that fasten the UIM onto the ‘support arm’.

User Interface Module (UIM)

Installation

1. While continuously supporting the replacement UIM, position the UIM’s four threaded mounting studs into the ‘support arm’, mounting plate and secure it with (4) nuts.
2. Feed the ‘UIM interface cable connector’ into the ‘plastic top cover’ opening, towards the rear of the chassis.
3. Slide the ‘plastic top cover’ back in place.
4. Install (2) Phillips screws and washers into the ‘UIM interface cable connector’ and secure it to the rear chassis.
5. Install (2) Phillips screws to secure the ‘plastic top cover’ to the rear chassis.
6. Install (1) Phillips screw located at the exhalation port marked EXH.
7. Use (4) 11/32 KEP nuts to secure the ‘plastic top cover’ opening onto the chassis.
8. Using a long Phillips screwdriver, install (1) Phillips screw at the top of the exhalation filter assembly well. Install the exhalation filter back into the filter well,
9. Tilt the UIM down and install the ‘back arm cover’. Install two mounting screws inside the ‘back arm cover’ and tighten them.
10. Install the ‘front arm cover’. Install (1) Phillips screw into the ‘front arm cover’ and tighten it.
11. Install the ‘rubber collar’ around the UIM rear neck.

WARNING

Always disconnect the white battery quick disconnect once the top cover is removed to prevent injury and/or damage to the AVEA Ventilator System.

Note

Prior to complete reassembly, UIM may be temporarily installed for testing and calibration.

Exhalation Filter Assembly/UIM

Removal

1. If installed, remove the exhalation filter assembly.
2. Rotate the metal locking lever on the lower right of the ventilator body forward to an open position. Remove the exhalation filter assembly from the ventilator body pulling straight down.
3. Remove the rubber collar by grasping one of the two rubber tabs at the bottom. Pull firmly in an “arcing” motion.
4. Remove the (1) Phillips screw on the front neck cover below the monitor and remove the front arm cover.
5. Remove the two mounting screws now visible inside the back neck cover.
6. Tilt down the UIM and remove the back neck cover. Remove the (2) Phillips screws and washers on the molded gray cover connector attached to the rear panel and unplug the UIM interface cable.
7. Using a long Phillips screwdriver, remove the (1) Phillips screw located at the top of the exhalation filter assembly well.
8. Remove the (1) Phillips screw located at the exhalation port marked EXH.
9. Remove the (4) 11/32 KEP nuts on the rounded portion of the molded plastic top cover.
10. While supporting the UIM continuously, remove (4) 3/8 KEP nuts holding the UIM in place on the aluminum ring.
11. Remove the 2 Phillip head screws from the back of the unit that attaches the plastic top cover to the pneumatic module.
12. Remove the UIM, then the plastic top cover.

Metal Top Cover

Removal

1. With the Plastic Top Cover removed, continue by removing the 19 SEMS screws, (3) on the left side (5) on the right side and (11) on top.

Note

The screws along the back of the metal top cover are different—flat head.

Note

For ease in removal of these screws it is recommended to use a power screw driver.

2. Remove metal top cover and set aside.
3. Disconnect the internal battery 2 pin Molex connector.

Warning

Assure that the work area is Electro Static Discharge (ESD) protected. The Printed Circuit Board Assemblies (PCB's) have integrated circuits (IC's) that can be severely damaged by static electricity. Work surface must be certified as anti static or grounded before removing covers and while working on the ventilator. Wear a properly grounded and tested anti-static strap prior to handling PCB's.

Gas Delivery Engine P/N 16222A

Gas Delivery Engine Removal

1. Referring to the instructions above, remove the UIM and molded metal top covers
2. Disconnect internal battery.
3. Disconnect the 4-pin connector from the battery monitor board to the gas delivery engine (51000-40022 Only).
4. Remove the (4) SEMS screws located at each corner of the rear panel.
5. Remove A/C power cord bracket.
6. Cut the tie wrap and remove the metal tubing support bracket and disconnect the tube from the accumulator outlet by releasing the compression fitting.
7. Completely remove the hose between the gas delivery engine assembly and the scroll pump/compressor filter.
8. Squeeze to remove the two small ribbon cables near the front of the gas delivery engine assembly (the 10-pin ribbon cable connector from the flow sensor assembly and the 20-pin ribbon cable connector from the front interface panel).

> **CAUTION**
>
> Never pull on a cable during disconnection. Damage to the connector wiring may result. Always pull on the connector body to disconnect.

9. Unscrew the luer-lock fittings (the clear yellow tubing from F4, and the black striped tubing from G4).

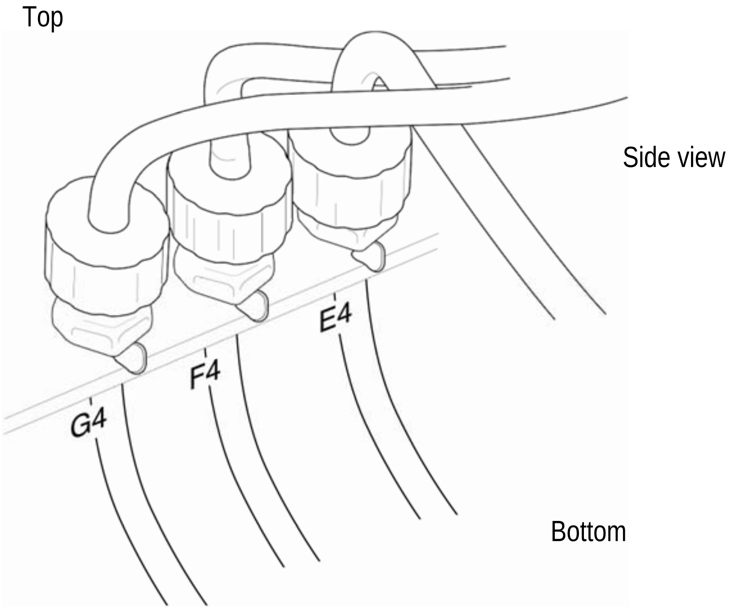


Figure 4-1 G4 and F4 luer connections

G4 (high side of expiratory flow and expiratory pressure XDCR 3 and 2)

Clear silicone tubing with black line

Top – goes to the expiratory flow sensor bulkhead

Bottom – goes to the expiratory manifold on the TCA

F4 (low side of expiratory flow)

Clear silicone tubing

Top – goes to the expiratory V sensor bulkhead

Bottom – goes to the expiratory manifold on the TCA

E4

Yellow tubing

Top – inspiratory pressure line that goes to the SOPR manifold

Bottom – inspiratory pressure that goes to the transducer on the TCA (XDCR 1)

10. Disconnect the yellow bleed tubing from C4 by releasing the compression fitting.
11. Disconnect the large blue tubing to the nebulizer from H4 by releasing the compression fitting.

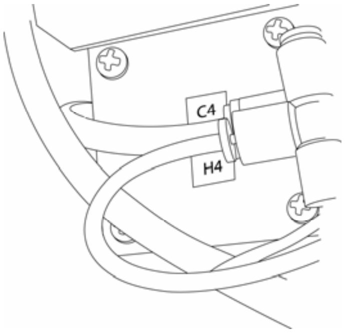


Figure 4-2 C4 and H4 compression fittings

Note: With replacement of the GDE, the position jumper J3 on the Secondary Alarm Board must be reviewed for proper placement.

G4 (high side of expiratory flow and expiratory pressure XDCR 3 and 2)

Clear silicone tubing with black line

Top – goes to the expiratory flow sensor bulkhead

Bottom – goes to the expiratory manifold on the TCA

F4 (low side of expiratory flow)

Clear silicone tubing

Top – goes to the expiratory V sensor bulkhead

Bottom – goes to the expiratory manifold on the TCA

E4

Yellow tubing

Top – inspiratory pressure line that goes to the SOPR manifold

Bottom – inspiratory pressure that goes to the transducer on the TCA (XDCR 1)

12. Disconnect the yellow tubing from (D4) that feeds the EPM board.
13. Loosen the 11/32 nut securing the assembly to the base at the bottom front left.
14. Ensure all cables and tubing are tucked into the gas delivery engine assembly and slide the assembly out of the unit towards the rear. You will here a distinct "pop" as the assembly disconnects from the driver transition board connection.
15. Remove the power cord support bracket.

Note

You may need to pull firmly as you slide out the gas delivery engine assembly because it is attached to the 120-pin connector on the driver transition board.

If you are removing Gas Delivery Engine P/N 510000-40022 please continue with the next step. If you are removing Gas Delivery Engine P/N 16222 please continue at step number 1 of Installation.

16. Locate the internal battery pack and cut the 2 purple wires located at the battery pack to 1.5" (inches).
17. Fold back onto itself, 1 of the wires that has been cut ¼" (inch).
18. Cut the wire that was not folded even with the wire that was folded, so that they are now even in length.
19. Cut a piece of heat shrink tube that has been supplied to I" (inch) in length.
20. Slide both purple wires that have been folded and cut into the heat shrink tube.
21. Ensure that both wires are inside the heat shrink tube and that neither wire is showing through the end of the heat shrink tube.
22. Using a heat gun or equivalent device, warm the heat shrink tube until it shrinks tight to the 2 purple wires that have been cut and folded previously.
23. Locate the Compressor power board located next to the compressor pump.
24. Remove the one 11/32" nut securing the ground wire from the compressor power board.
25. Remove the 2 11/32" nuts securing the compressor power board to the unit case.
26. Raise the compressor board up and away from the unit enough to allow disconnection of the 2 wire harnesses.
27. Cut the ground wire 1"(inch) from the compressor power board.
28. Fold back onto itself, the cut wire ¼" (inch) that is attached to the Compressor Board.
29. Cut a piece of heat shrink tube that has been supplied to I" (inch) in length.
30. Slide the wire that has been folded and cut into the heat shrink tube.
31. Using a heat gun or equivalent device, warm the heat shrink tube until it shrinks tight to the wire that was cut and folded previously.
32. Reconnect the 2 wire connectors to the Compressor Power Board.
33. Re-install the Compressor Power Board to the unit case using the 2 11/32" (inch) nuts.
34. Cut all tie straps securing Battery Monitor Board P/N 16105.
35. Disconnect the 2 pin connector of the battery monitor board from the 2 pin connector containing wires #12 and #13.

36. Disconnect the 4 pin connector from the battery monitor board to the battery.
37. Disconnect wire #14 from the black wire of the battery monitor board.
38. Disconnect the 2 wires from the fuse holder. The battery monitor board will now be free to remove from the unit.
39. Connect wire # 14 to the straight terminal of the fuse holder.
40. Connect wire harness (internal battery upgrade cable assembly) P/N 16243 2 pin connector to the 2 pin connector containing wires # 12 and #13. Secure using cable tie P/N 05038.
41. Connect the black wire from cable harness P/N 16243 to the right-angle terminal connector of the fuse holder.
42. Connect the 4 pin connector of the internal battery to the 4 pin connector of P/N 16243. Secure 4 pin connector using cable tie P/N 05038.

Installation

WARNING

Prior to re-installing the GDE, insure that C31 is not touching the Flow Control Valve or that there is insulation material between the two. (C31 is the orange capacitor located closest to the top of the FCV).

1. Ensure all cables and tubing are tucked into the gas delivery engine assembly and slide it as far into the unit as required to hold the assembly. Do not yet connect the assembly to the driver transition board.
2. Connect yellow hose (D4) to the EPM board.
3. Connect the tubing from the EPM board into C4 by inserting into the compression fitting.
4. Connect the yellow bleed tubing from the sensor assembly; the clear yellow tubing to F4, and the blue tubing to G4. To connect into the luer lock fittings, twist and push.
5. Connect the clear tubing from the sensor assembly to F4 luer lock fitting, and the black striped tubing to G4 luer lock fitting.
6. Connect the two ribbon cables located at the front of the ventilator (the 10-pin ribbon cable to J17 and the 20-pin ribbon cable to J16).
7. Connect the 4-pin battery monitor board to the gas delivery engine.
8. Engage the gas delivery engine to the driver transition board by ensuring proper alignment of the two alignment pins and the connector. Press firmly into place.

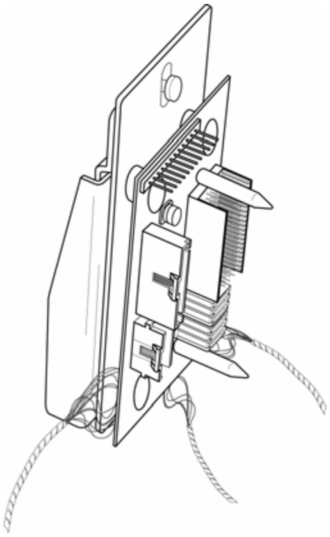


Figure 4-3 Gas Engine Connector on Driver Transition PCB

CAUTION

It is essential to ensure correct alignment to the 120-pin connector on the driver transition board (see diagram) before pushing home the gas delivery engine. Failure to do so may result in damage to the connector and the unit may not power up or operate properly.

9. Attach and secure the (4) SEMS screws on the four corners of the rear panel.
10. Replace the yellow hose from the gas delivery engine to the compressor filter.
11. Connect yellow hose from the accumulator into the compression fitting. Replace the metal safety bracket, and secure with a new tie wrap.
12. Tighten the 11/32 nut at bottom right of the Gas Delivery engine and tighten down.
13. Attach the User Monitor Interface and cable.

Note

Perform the Calibration and Operational Verification Procedure located in the AVEA service manual.

14. Once all tests are preformed, remove the User Interface Module and install the metal cover and all associated screws.
15. Install plastic top cover and User Interface Module (UIM).

Note

Perform the Extended Service Test (EST) once the unit is completely re-assembled and prior to patient setup

Ventilator wheeled base

Removal

1. Unscrew the (4) thumbscrews on attaching the base to the ventilator body as shown in figure 4.4 and detach from the wheeled base.

Installation

2. Position the ventilator assembly onto the base by lining up the holes over the 4 spring-loaded thumbscrews and tighten the thumbscrews.

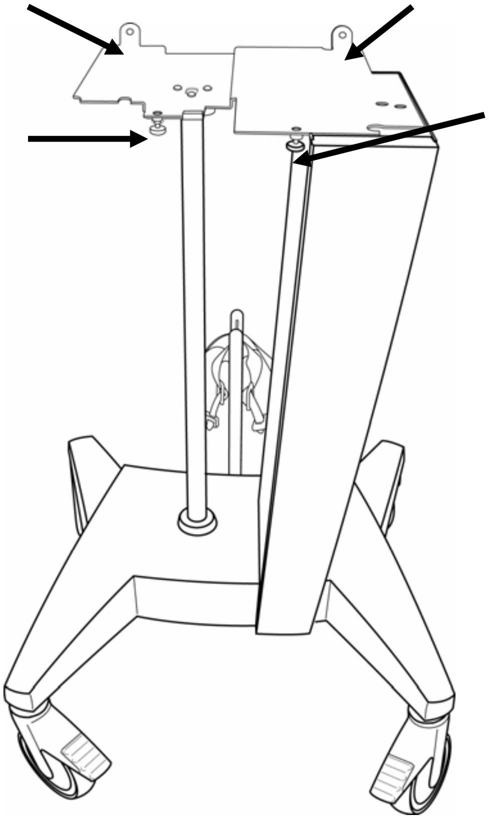


Figure 4-4 Wheeled base showing attachment points

Internal Batteries P/N 68339A

Removal

1. Referring to the instructions in this chapter, remove the following components:
   UIM and the top cover
2. Internal battery fuse holder
3. Disconnect the battery fuse holder by pulling straight back on the two faston connectors.
4. Remove the fuse holder and fuse from the ventilator chassis using pliers to remove nut.
5. Remove the (3) 11/32 KEPS nuts that hold the battery bracket in place; (2) KEPS nuts on the bottom and (1) on the top.
6. Slide out the retaining bracket and the batteries.

Figure 4-5 Battery fuse holder & Bracket

7. Disconnect the positive and negative leads from the wire harness that connects to the driver transition board.
8. Cut both tie wraps that secure the battery monitor board and the 4-pin molex to the batteries.
9. Disconnect the batteries from each other.

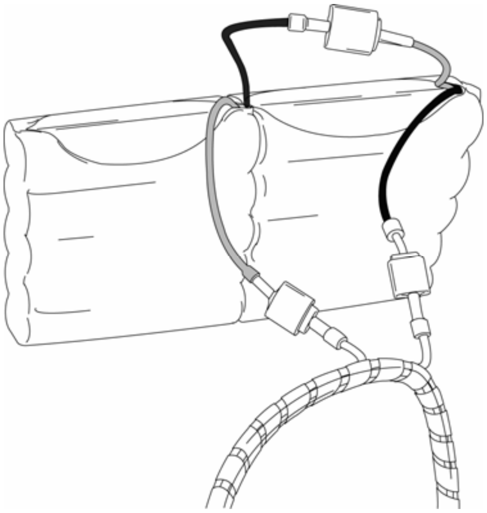


Figure 4-6 Battery Assembly

Installation

1. Cut three 3” stripes of 1” wide double-backed adhesive tape. Place one strip on the bottom of one battery, and the other two strips on the top and bottom of the other battery.
2. Place the first battery against the chassis and the second battery on top of the first.
3. Secure the batteries into place with the retaining bracket by using (3) 11/32 KEPS nuts; (2) KEPS nuts on the bottom and (1) on the top.
4. Connect the positive and negative battery leads to the wire harness that connects to the driver transition board. (These are arranged M-F and F-M so they cannot be wrongly connected)
5. Replace the fuse holder into the front of the chassis.
6. Connect the lug connectors to the two battery fuse terminals using either combination of wires.
7. Referring to the instructions in this chapter, install the following components:
   UIM and the top cover.

FUSES

The AVEA has replaceable fuses associated with internal DC, external DC and AC power sources. Please refer to your present power requirements which are detailed on the rear of the AVEA.

Line Voltage	Fuse	Amperage (350 Watt Power Supply)	250 Watt Power Supply
100/120VAC	(2) 250 V 6.35 X 31.75mm	3.15 amp (Viasys P/N 71692)	1.5 amp (Viasys P/N 71698)
230/240VAC	(2) 250 V 6.35 X 31.75mm	6.3 amp (Viasys P/N 03490)	3.15 amp (Viasys P/N 71692)

WARNING

Do not remove or replace fuses or perform any maintenance tasks on the ventilator while your patient is connected. Always perform these tasks “off patient”.

Battery Fuses

The internal and optional external battery fuses are 10A, 250V 5 x 20 mm fast blow type.

The fuse for the optional external battery is located on the back panel next to the external battery connector and is replaceable. The fuse for the internal battery is located to the right of the UIM connection. To remove fuses, carefully unscrew with a flat blade screwdriver and pull out the fuse holder.

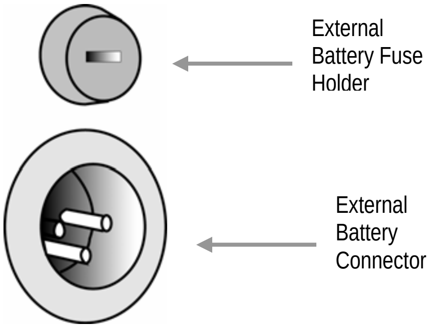


Figure 4-7 External Battery Connector & Fuse

WARNING

To avoid fire hazard, use only the fuse specified in the ventilator’s parts list or one that is identical in type, voltage rating, and current rating to the existing fuse.

Mains Fuses

The main AC power fuses are housed within the power entry module located on the back panel. They are slow blow-type. Check that the correct voltage for your mains supply is showing through the window in the power entry module.

Table 4-1 Mains fuses

Line Voltage	Fuse	Amperage
100/120VAC	250V 6.35 x 31.75mm	3.2A
230/240VAC	250v 6.35 x 31.75mm	1.5A

Replacing a Mains Electrical Fuse

WARNING

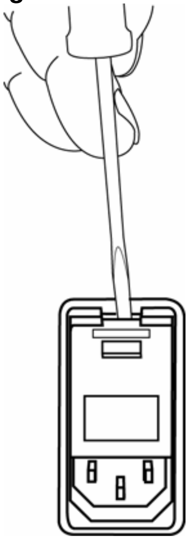
Ensure that the mains power cord is unplugged before attempting to remove or replaces fuses.

To replace mains electrical fuses, refer to figures 4-8 through 4-12 and do the following:

1. Unplug the ventilator from the mains AC power source and unplug the power cord from the power entry module on the rear of the ventilator.
2. Using a small flat blade screwdriver, pry open the cover of the power entry module.
3. Carefully ease the red fuse holder out of the power entry module.
4. The fuse holder contains two identical fuses, either 3.1Amp for (for 100/120 volt lines) or 2.0 Amp (for 230/240 volt lines) as shown in table 6.1.
5. Replace the failed fuse in the fuse holder with a fuse whose type, voltage rating, and current rating is identical to the fuses supplied from the factory.
6. Carefully replace the red fuse holder into the power entry module. Check to ensure that the correct line voltage is uppermost as you re-insert the fuse holder into the power entry module.
7. Close the power entry module cover and check to make sure that the correct voltage is displayed through the window.

Changing the AC Fuses:

Figure 4-8



Opening the power entry module with a screwdriver

Figure 4-9

Removing the fuse holder

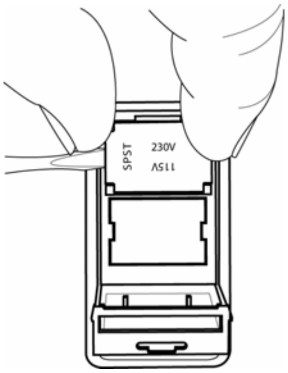
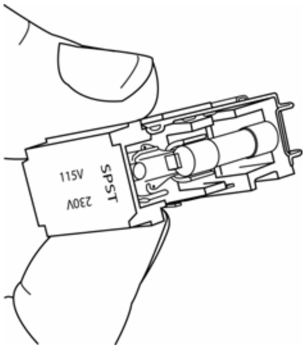

SPST
230V
115V

Figure 4-10


115V
SPST
230V

Fuse holder showing fuse placement

Figure 4-11

Fuse-holder with 230V label uppermost for 230/240VAC systems.

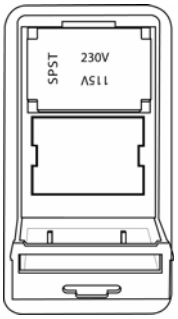
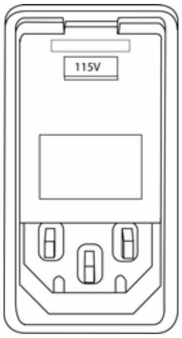

SPST
230V
115V

Figure 4-12



closed power entry module with 115V showing in the window for 100/120 volt systems

Compressor/Scroll Pump P/N 51000-09750A

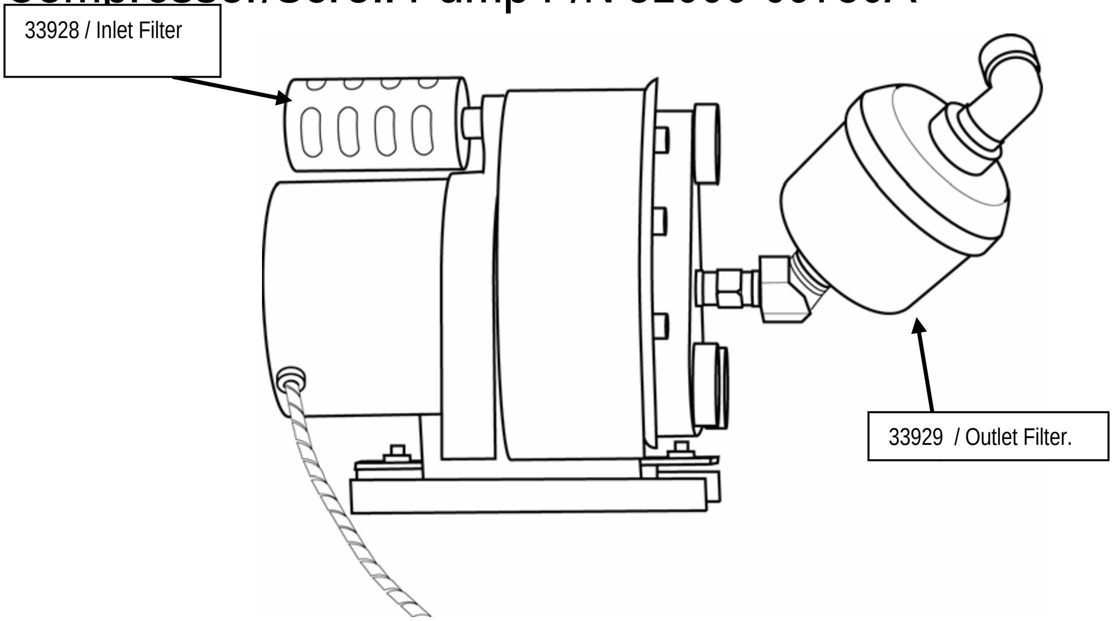


Figure 4-13 **Compressor/ Scroll Pump**

Removal

1. Referring to the instructions in this chapter, remove the following components: UIM and the top cover.
2. Remove high pressure hose from compressor motor at the filter outlet. Move the high pressure hose out of your working area.
3. Disconnect from A/C power.
4. Disconnect internal battery.
5. Remove the (4) 11/32 KEPS nuts in each corner of the compressor mounting base. Remove the (1) ground wire located at the front right of the compressor.
6. Disconnect compressor wiring harness (molex P2) from compressor driver board.
7. Carefully lift compressor pump to clear the power board shield.
8. Access the 12-pin scroll pump connector and disconnect from the driver transition board.
9. Remove the (2) KEPS nuts on the scroll compressor board (1) on the right and (1) on the front, and remove the compressor board.
10. Scroll pump is now completely detached.
11. Remove from the unit and set aside.

Note

Compressor power board should be placed in an antistatic bag.

Installation

1. Slide the compressor/scroll pump in the front right side of the ventilator and position over the (4) studs.
2. Install ground wire over right front stud and secure with one of the 11/32 KEPS nuts.
3. Secure compressor using the (4) 11/32 KEPS nuts over the (4) studs.
4. Connect 8-pin Molex connector from compressor to compressor driver board.

Note

Ensure the scroll compressor assembly is seated below the wire that runs from the driver transition board to the fan and push down the wire harness from the driver transition board under the front of the scroll pump to avoid wedging it between the scroll pump and the chassis

5. Position the scroll compressor board onto two studs and secure with (2) KEPS nuts; (1) on the right and (1) on the front. Inlet 33928 / & outlet 33929 / Filters (0.3 microns)
6. Reattach the high pressure hose to the filter outlet.
7. Referring to the instructions in this chapter, re-install the following components:
   - UIM and the top cover.

Enhanced Patient Monitor (EPM) Board P/N 51000-40848A

Removal

1. Referring to the instructions in this chapter, remove the following components:
   - UIM and the top cover
   - Ventilator assembly (from the base)
2. Remove the flow sensor cover by removing the (3) SEMS screws.
3. Remove the (2) KEPS nuts; the brss colored EMI shield, and blue flex cable.
4. Disconnect the 10-pin ribbon cable from the front of the GDE.
5. Turn the unit on its’ side.
6. Remove (7) Phillips screws; 2 from the lower back panel and (5) from the bottom panel.
7. Remove bottom panel.
8. Remove (2) screws from the top of the front panel.
9. Loosen (2) KEPS nuts from the bottom that hold the front panel.
10. Pull off front panel.
11. Loosen (1) KEPS nut from the bottom and (4) screws on the front panel.
12. Remove the blue tubing from the nebulizer to the front panel.
13. Gently pull the blue ribbon cable through the narrow slot at the top center fo the front interface panel and the rest of the wiring through the recessed compartment in the chassis.

CAUTION

Never pull on a cable during disconnection.

Installation

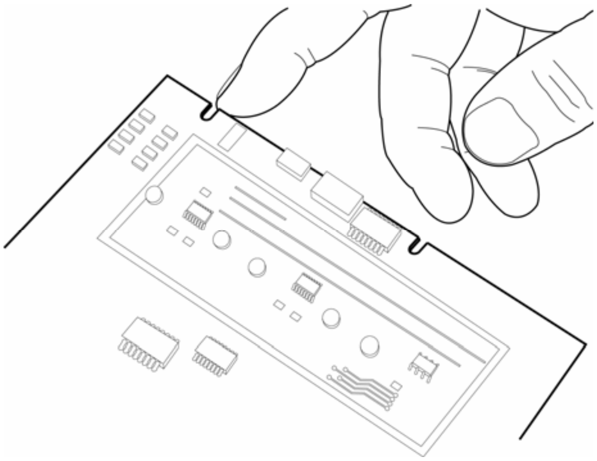


Figure 4-14 **EPM Board alignment notches**

Note

Ensure that you do not pinch any tubing since this can result in damage to the AVEA.

1. Gently feed the blue ribbon cable through the narrow slot at the top center of the front panel and the wiring through the recessed compartment in the chassis.
2. Attach the blue tubing from the nebulizer to the front panel.
3. Tighten (1) KEPS nut on the bottom and (4) screws on the front interface panel.
4. Position the front panel and install (2) KEPS nuts on the bottom and (2) screws on the bottom of the front panel.
5. Position the back panel and install (7) Phillips screws; (2) on the lower back panel and (5) on the bottom panel.
6. Turn the unit over.
7. Install the (2) KEPS nuts, the EMI shield, brass bracket and ribbon cable.
8. Attach the flow sensor cover by installing the (3) SEMS screws.
9. Referring to this chapter, install the following components:
   Ventilator assembly onto the base
   UIM and the top cover

Fan Assembly P/N 51000-40861

(12 VDC, 550mA)

Removal

1. Referring to the instructions in this chapter, remove the following components:UIM and the top cover.
2. Disconnect the fan cable from the wire harness of the TCA board.
3. Pop off the fan filter cover.
4. Remove the filter and the filter cover.
5. Remove the (4) 2.5” Phillips screws holding the fan filter housing. Remove the fan assembly and the fan cover.

Installation

1. Insert the honeycomb shield into the shroud.
2. Insert the fan assembly into the shroud, ensuring the wire assembly is facing towards the lower outside corner of the ventilator.
3. Align the fan cover on the outside of the chassis and the fan assembly on the inside using (1) screw to assist in positioning.
4. Secure both the fan cover and the fan assembly with (4) 2.5” Phillips screws.
5. Connect the fan cable to the TCA wire harness.
6. Tuck the wire harness along side the fan between the fan and the outer wall of the unit.
7. Place the filter inside the filter cover so that the locking tabs face the chassis and snap the filter cover into place.
8. Referring to the instructions in this chapter, install the following components:
    - UIM and the top cover.

Power Supply P/N 16388

Tools Required

- Phillips #2 screwdriver with 8” shaft
- 11/32 nut driver
- 3/8 nut driver
- Side cutters
- Needle-nosed pliers

Removal

1. Referring to the instructions in this chapter, remove the following components in the following order:
   - UIM and the top cover.

Note

To gain access to the power supply, the aluminum shield under the plastic top cover must also be removed. There are (19) SEMS screws; (3) on the left, (5) on the right and (11) on top.

   - Fan assembly
   - EPM board (It is not necessary to remove this board when gaining access to the power supply. Please see instructions at the end of this procedure).
   - Scroll pump/compressor.
2. Cut and remove all cable ties that secure the wire assemblies to the power shield.
3. Disconnect the 5-pin connector at J2.

NOTE

It is suggested to label the (3)wires coming from the 3-pin terminal block as neutral (blue), load (brown) and ground (green and yellow) as printed on the power supply circuit board.

4. Using a Phillips screwdriver, loosen the screws of the terminal block that secures wires #1 and #3 and remove.
5. Remove and label blue (neutral) and brown (load) wires on the power entry module.
6. Remove the (4) 11/32 KEPS nuts (2) on the left and (2) on the right. Pull out the power supply including the brass bracket. Part number:

Installation

1. If installing a new power supply, you will need to install (4) cable mounts on the new power supply. Use the old power supply as a model for the location on the new power supply.
2. Reconnect the (3) wires from the power entry module to the 3-pin terminal block of the power supply board.

3. Seat the power supply and the bracket into the chassis and secure with (4) 11/32 KEPS nuts; (2) on the left and (2) on the right.
4. Reconnect the (2) wires, # 1 and #3 from the terminal block.
5. Reattach the 5-pin connector to the power supply board location J2.
6. Replace the cable ties.
7. Reinstall lock washer, ground wire and nut securely.
8. Secure wiring harness with cable ties to power supply shield.
9. Referring to the instructions in this chapter, install the following components in the order listed:

- Scroll Pump / Compressor
- EPM board. (If not removed, return the EPM to its' position on the (2) mounting studs and secure using the (2) Phillips screws.
- Fan assembly.
- Scroll compressor.
- UIM and the top cover.

Table 4-2 AVEA Power supply specifications

INPUT	OUTPUT
TB1	TB2
6-32 3 pin terminal block	6-32 4 pin terminal block 0.375 ctr
PIN 1 AC line	Bus bar with 10-32 screw on high current models
Pin 2 AC neutral	Pins 1 and 2 +V out
Pin 3 AC ground	Pins 3 and 4 Return
	16A max recommended current per connector pin
Signals J2	
Amp PCB Header	
Mating connector	
Pin 1 DC Good	
Pin 2 Power fail	
Pin 3 Ext off	
Pin 4 + Sense	
Pin 5 -Sense	
Fan	
AMP PCB Header	Maximun screw protrusion above chassis = 0.120”
Mating Connector	
Pin 1 -	Weight 2.9 lbs (1.32Kg) max.
Pin 2 +	

To Clear EPM Board From Workspace During Replacement Of Power Supply:

1. Remove the (2) Phillips screws that secure the EPM to the center bracket.
2. Pull firmly, straight up. This action will release the EPM board from the mounting studs.
3. Without disconnecting any tubes, hoses or wires, place the EPM board into a static bag and set out of the way of the compressor and power board.

Exhalation Valve P/N 16319 and Exhalation Flow Sensor Assembly P/N 51000-40023

Exhalation housing P/N 20030

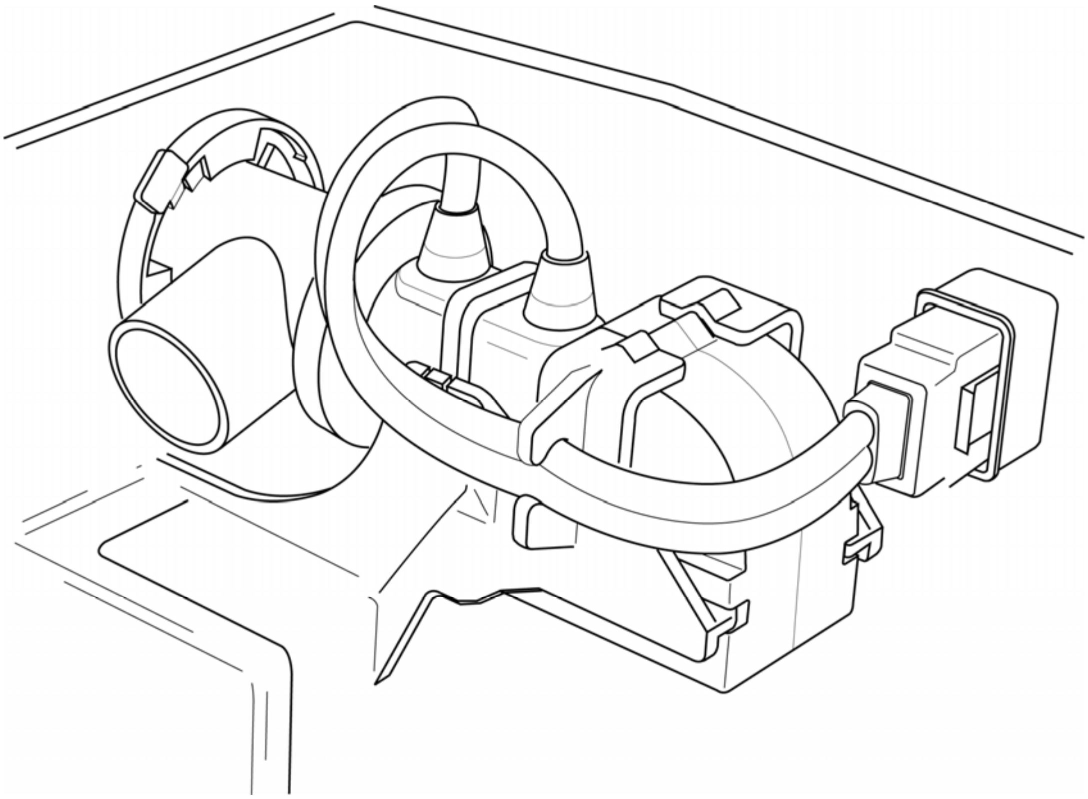


Figure 4-15 **Exhalation Valve and Flow Sensor* Assembly**

Removal

1. Referring to the instructions in this chapter, remove the following components:
    - UIM and the top cover.
    - Exhalation filter (51000-40640) & watertrap assembly (50000-40035).
2. Remove the third (and last) screw from the exhalation assembly cover of the left hand corner of the AVEA. Remove the cover.
3. Pull the locking shroud of the connector back and disconnect the sensor from the chassis.
4. Grasp the rubber elbow and slide it towards you and remove.

5. Gently remove the exhalation flow sensor by pulling straight towards you.
6. Push in the locking tab on the exhalation valve body and twist the body counterclockwise to remove.
7. Remove the silicon diaphragm from the exhalation valve assembly.
8. Disconnect the two wires from the wiring harness.
9. Carefully cut the cable tie retaining the exhalation valve.
10. Remove the (2) KEPS nuts and Phillips screws from the top and bottom of the exhalation valve assembly and the bracket. (recommend using a 3/8 box or open-end wrench for this task)
11. Remove the exhalation valve by sliding it out of the brackets and slightly spreading the mount so as not to damage the wires..

CAUTION

Ensure that you do not damage the small wires when removing the exhalation valve.

Installation

1. Position the exhalation assembly onto the chassis by lining up the screw holes on the front panel and sliding it into the exhalation valve bracket.

CAUTION

Ensure that you do not damage the small wires when installing the exhalation valve.

2. Install the (2) Phillips screws through the top and bottom of the exhalation valve assembly and the bracket and secure with (2) KEPS nuts.
3. Connect the cables to the wiring harness.
4. Leaving room for the gas delivery engine, run the wire harness under the tab in the exhalation valve assembly bracket.
5. Insert the silicon diaphragm (P/N 16240) into the exhalation valve body by seating it into the lip with the point out.
6. Install the exhalation valve body; line up the flange on the valve body with the tabs on the receptacle and twist clockwise until secure.
7. Install the exhalation flow sensor by sliding it into the gasket with the tubing facing up and ensure the tubing is under the retaining notch.
8. Slide the blue rubber elbow sensor boot in by lining it up with the grooves.
9. Attach the connector to the chassis by pulling back the plastic sleeve and pushing it into place.
10. Push the locking clip back to secure the sensor.
11. Reinstall the exhalation assembly cover using 2 of the 3 screws (side and bottom front).
12. Referring to the instructions in this chapter, re-install the following components:

- UIM and the top cover.

Heater Assembly P/N 51000-40824

Removal

1. Remove the (4) Phillip #1screws holding the shield.
2. Remove (2) KEP nuts at the base.
3. Disconnect the 3-pin and 2-pin connectors and label.
4. Remove (2) 11/32 KEP nuts on the back of the front panel shielding the flow sensor PCB.
5. Remove (2) Phillips #2 screws from the front panel.
6. Remove corner piece
7. Remove screws (4) Phillip #1 holding shield.
8. Remove heater assembly
9. The top cover.
   - Exhalation Valve and Flow Sensor Assembly
   - Remove the screws holding the shield and remove shield.
   - Remove heater assembly

Installation

When removing and installing the corner and heater assembly, do not replace the plastic piece of the front panel or the bottom piece of the ventilator until corner/heater assembly is in place.

1. Referring to the instructions in this chapter, install the following components:
2. Reinstall heater assembly into the shield using (4) Phillips #1 screws.
3. Attach corner to the base assembly using (3) KEPS nuts and (2) Phillips #2 screws.
   - Re-attach heater.
   - Re-attach shield.
   - Exhalation Valve and Flow Sensor Assembly
   - UIM and the top cover.

Microswitch, Top Cover P/N 68294

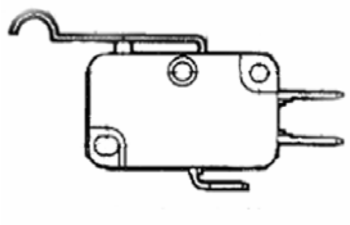


Figure 4-16 **Top Cover Micro Switch**

Removal

1. Referring to the instructions in this chapter, remove the following components:
- UIM and the top cover.
2. Remove attachment screws, disconnect and lift off the micro switch.

Installation

1. Reattach using screws provided. Re-connect the wiring.
2. Referring to the instructions in this chapter, install the following components:
- UIM and the top cover.

EMI Shield

Removal

1. Referring to the instructions in this chapter, remove the following components:
- UIM and the top cover.
2. Remove the protective box cover by removing the (1) Phillips screw.
3. Remove the EMI shield protective box by removing the (2) KEPS nuts that secure it.

Installation

1. Replace the EMI shield protective box and secure it with (2) KEPS nuts.
2. Replace the protective box cover and secure with (1) Phillips screw.
3. Referring to the instructions in this chapter, install the following components:
- UIM and the top cover.

Front Interface Panel P/N 51000-40635

Removal

1. Referring to the instructions in this chapter, remove the following components:
    - UIM and the top cover.
    - Ventilator assembly (from the base).
    - Gas delivery engine assembly.
2. Remove the flow sensor cover by removing the (3) SEMS screws.
3. Remove the (2) KEPS nuts, the EMI shield, brass bracket, and ribbon cable.
4. Turn the unit over and support it on 2x4 pieces of wood so as not to put the entire weight of the unit on the 4 standoffs.
5. Remove (7) Phillips screws; (2) from the lower back panel and (5) from the bottom panel.
6. Remove bottom panel

7. Remove (2) screws from the top of the front panel.
8. Loosen (2) KEPS nuts from the bottom that hold the front panel.
9. Pull off the front panel.
10. Loosen (1) KEPS nut from the bottom and (4) screws on the front panel.
11. Remove the blue tubing from the nebulizer to the front panel.
12. Gently pull the blue ribbon cable through the narrow slot at the top center of the front interface panel and the rest of the wiring through the recessed compartment in the chassis.

Installation

1. Gently feed the blue ribbon cable through the narrow slot at the top center of the front panel and the wiring through the recessed compartment in the chassis.
2. Attach the blue tubing from the nebulizer to the front panel.
3. Tighten (1) KEPS nut on the bottom and (4) screws on the front interface panel.
4. Position the front panel and install (2) KEPS nuts on the bottom and (2) screws on the bottom of the front panel.
5. Position the back panel and install (7) Phillips screws; (2) on the lower back panel and (5) on the bottom panel.
6. Turn the unit over.
7. Install the (2) KEPS nuts, the EMI shield, brass bracket, and ribbon cable.
8. Attach the flow sensor cover by installing the (3) SEMS screws.
9. Referring to the instructions in this chapter, install the following components:
    - Ventilator assembly onto the base.
    - Gas delivery engine assembly.
    - UIM and the top cover.

Transition board with harness P/N 16216

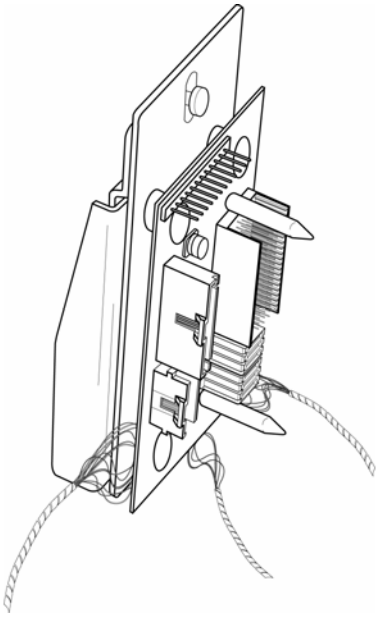


Figure 4-17 **Driver transition board**

Removal

1. Referring to the instructions in this chapter, remove the following:
- UIM and the top cover.
- Gas delivery engine assembly.
- Fan assembly connections
- Scroll compressor connections.
- Front interface panel connections.
2. Disconnect the wiring to the power supply board and the battery.
3. Remove the spiral wrap to the alarm connector, and feed the wires out of the hole in the chassis one connector at a time.
4. Remove the (2) Phillips screws and flat washers from the chassis.
5. Remove the Phillips screws on the board bracket and remove the board from the bracket.

Installation

1. Mount the driver transition board into the first half of the bracket; place the board on the three round threaded studs with the cables spread outward, and secure the (3) Phillips screws.
2. Place the flat side of the other half of the bracket on the two mounting pins and slide it down.
3. Install (1) Phillips screw from the front to the rear of the bracket and leave finger tight.
4. Align the bracket over the two threaded holes in the chassis and install (2) Phillips screws using flat washers.

5. Align the driver transition board; slide in the gas delivery engine assembly, carefully connect it to the driver transition board, adjusting the bracket as necessary.
6. Once the alignment is complete, secure the driver transition board and the height adjustment pin on the bracket, and then remove the gas delivery engine assembly.
7. Feed the top wiring harness through the small hole in the front right of the chassis, one connector at a time.
8. Install the spiral wrap, leaving the alarm connector hanging off to the side.
9. Make the appropriate connections to the power supply board and to the battery.
10. Referring to the instructions in this chapter, install the following components:
    - Front interface panel.
    - Scroll compressor.
    - Fan assembly.
    - Gas delivery engine assembly.
    - UIM and the top cover.

Alarm Speaker P/N 51000-40818

Removal

1. Referring to the instructions in this chapter, remove the following components:
    - UIM and the top cover.
    - Ventilator assembly from the base.
    - Bottom cover.
    - Front panel.
2. Turn the unit over and support it on 2x4 pieces of wood to avoid putting the entire weight of the unit on the 4 standoffs.
3. Disconnect the wire to the driver transition board.
4. Remove the (2) 11/32 KEPS nuts that secure the speaker and lift the speaker off of the threaded studs.

Installation

1. Position the speaker onto the two threaded studs and secure with (2) 11/32 KEPS nuts.
2. Connect the wire to the driver transition board.
3. Referring to the instructions in this chapter, install the following components:
    - Bottom cover.
    - Front panel.
    - Ventilator assembly onto the base.
    - UIM and the top cover.

Nebulizer Assembly P/N 51000-40026

Note

Nebulizer may be activated when using an external compressed air source. It is inactive during use of the optional internal compressor.

Removal

1. Referring to the instructions in this chapter, remove the following components:
    - UIM and the top cover.
    - Ventilator assembly from base.
    - Bottom cover.
2. Cut tie wraps on the nebulizer booster.
3. Remove wire harness.
4. Disconnect the two solenoid connectors to the driver transition board.
5. Disconnect the tubing from the accumulator.
6. 6 Remove the (3) KEPS nuts that secure the nebulizer; (2) on the left side and (1) on the right, Maneuver the nebulizer out from behind the accumulator.
7. Disconnect blue tube just in front of the solenoid.

Installation

1. Turn the unit over and support it on 2x4 pieces of wood so as not to put the entire weight of the unit on the 4 standoffs.
2. Position the nebulizer onto the three threaded studs and using ong needle-nosed pliers, secure with (3) 11/32 KEPS nuts; (2) on the left side and (1) on the right.
3. Connect the tubing from the accumulator to the left side of the nebulizer.
4. Feed the tubing from the gas delivery engine through the U-shaped notch on the left side of the chassis and connect it to the nebulizer.
5. Connect the two solenoid connectors from the driver transition board.
6. Referring to the instructions in this chapter, install the following components:
    - Bottom cover.
    - Gas delivery engine assembly.
    - UIM and the top cover.

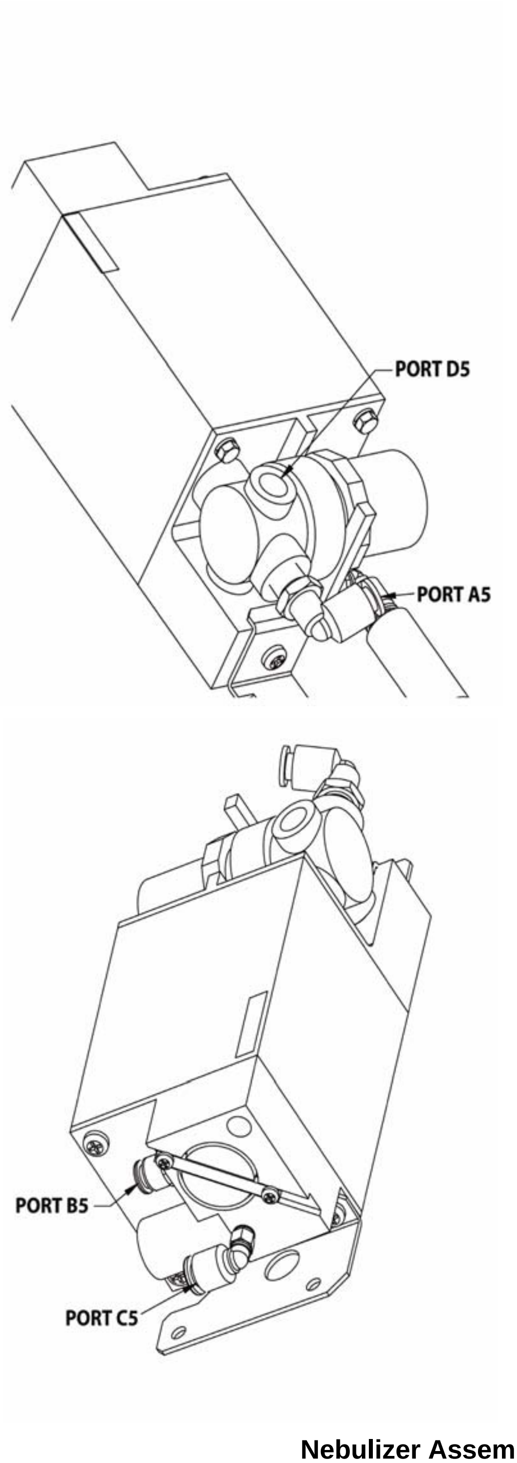

PORT D5
PORT A5
PORT B5
PORT C5

Figure 4-18 **Nebulizer Assembly showing ports**

Accumulator P/N 51000-40748

Removal

1. Referring to the instructions in this chapter, remove the following components:
    - UIM and the top cover.
    - Gas delivery engine assembly.
    - Ventilator assembly from base.
    - Bottom cover.
    - Front panel.
    - Speaker.
    - Nebulizer.
2. Disconnect the solenoid cable from the driver transition board.
3. Disconnect the tubing from the solenoid drain panel.
4. Remove the (4) 11/32 KEPS nuts; one from each corner.
5. Remove the accumulator, twisting to carefully remove the gas delivery engine supply tubing out of the slot on the bottom left of the chassis.

Installation

1. Turn the unit over and support it on 2x4 pieces of wood so as not to put the entire weight of the unit on the 4 standoffs.
2. Rotate the supply tube to the gas delivery engine into the slot on the bottom left of the chassis.
3. Position the accumulator by sliding the two notches over the threaded studs at the bottom and seating the top onto the two mounting studs.
4. Secure the accumulator with (4) 11/32 KEPS nuts, one on each corner.
5. Connect the tubing to the solenoid drain panel.
6. Connect the solenoid cable to the driver transition board.
7. Referring to the instructions in this chapter, install the following components:
    - Speaker.
    - Bottom cover.
    - Front panel.
    - Nebulizer.
    - Ventilator assembly onto the base.
    - Gas delivery engine assembly.
    - UIM and the top cover.

Secondary Alarm Installation (KitP/N 16316)

The purpose of the secondary (back up) alarm is to sound when a ventilator inop occurs and the secondary alarm electronics detects the primary alarm is not functioning.

General Instructions and Warnings

The removal and installation of major subassemblies requires OVP and calibration. Refer to Service Manual L1524.

When disassembling or assembling the AVEA, refer to the tubing diagram, P/N 51000-40840, the wiring diagram P/N 51000-40839 and appropriate schematics and assembly drawings located in Appendix B of the Service manual L1524. The illustrations shown here are for reference only, current revisions of these diagrams and schematics are available to qualified personnel from VIASYS Healthcare, Critical Care Division, Technical Support.

WARNING

ALWAYS TAKE STANDARD ESD PRECAUTIONS WHEN WORKING ON AVEA VENTILATOR SYSTEMS.

Assure that you are adequately earth grounded prior to handling and working inside of the AVEA ventilator.

Ensure the ventilator is disconnected from the AC and DC power supplies before performing repairs or maintenance. When you remove any of the ventilator covers or panels, disconnect the internal battery “quick release” connector before working on the ventilator. If the ventilator has an external battery installed, ensure that the external battery is unplugged from the rear panel before proceeding.

Recommended Tools & Equipment

Note

Before using any test equipment [electronic or pneumatic] for calibration procedures, the accuracy of the instruments must be verified by a testing laboratory. The laboratory master test instruments must be traceable to the National Institute of Standards Technology (NIST) or equivalent. When variances exist between the indicated and actual values, the calibration curves [provided for each instrument by the testing laboratory] must be used to establish the actual correct values. This certification procedure should be performed at least once every six months. More frequent certification may be required based on usage.

Long & short Philips screwdrivers
Flat bladed screwdriver
Side Cutters
11/32” Nut Driver (8”shank)
3/8” Nut Driver
5/16” Nut Driver
Thin Needle-nose Pliers

WARNING

Always disconnect the white battery quick disconnect once the top cover is removed to prevent injury and/or damage to the AVEA Ventilator System.

Note

Prior to complete reassembly, UIM may be temporarily installed for testing and calibration.

1. Remove UIM
2. Remove Metal Shield Cover and set aside
3. Remove wires #14 and #63 from the fuse holder.
4. Using an 11/32" nut driver remove the 3-Kep nuts securing the battery to the chassis.
5. If necessary remove the fuse holder from the chassis.
6. Cut cable ties securing the battery connector and disconnect the battery. Carefully remove battery pack from the unit and set aside.
7. Remove pneumatic module from the cart.
8. Carefully lay the unit so that the bottom plate is facing up.
9. Remove the 5 screws from the base assembly and the 2 screws from the back panel.
10. Remove base plate and set aside.
11. Cut the cable tie that secures the wires and the blue tube to the nebulizer block. Move wires and tube out of the way for the secondary alarm installation.
12. Remove the cable tie bridge from the nebulizer block and discard.
13. Using an 11/32" nut driver loosen the 2-Kep nuts securing the speaker alarm.
14. Using an 11/32" nut driver loosen the 1- Kep nuts securing the metal front plate (this is the plate that has the battery LED's).
15. Disconnect the blue tube from the regulator and move it out of the way.

Note:

If the unit is serialized prior to ADV03500 repositioning the jumper at J3 maybe be required. See photo #6.

16. Install the Secondary alarm assembly as shown in photo #1 ensuring that the back of the Secondary alarm bracket is flush against the nebulizer block.

CAUTION

ensure all wires and tubes are out of the way prior to installing the Secondary alarm assembly.

17. Using an 11/32" nut driver tighten the 2-Kep nuts securing the Secondary alarm in place.
18. Using an 11/32" nut driver tighten the remaining Kep nut.
19. Connect wires from the Secondary alarm as follows.
    1. Wires #66 to #25 and #26

2. Disconnect Wires #31 and #32 from the Speaker Alarm connection labeled 51000-40818.
3. Wires #68 and #69 to Wires #31 and #32
4. Connect wires labeled 51000-40818 to **J1** located on the Secondary alarm P.C.B.A.

20. Locate wire #70/71 this will be the longest wire with split coupling at the end.
21. Feed wire #70/71 underneath the tubes and solenoids and through the access hole in the chassis were the yellow and blue tube feed through into the GDE area. See photo #2
22. Once wire #70/71 is fed through the access hole, set the pneumatic module on its side and pull wire #70/71 all the way through the access hole.
23. Feed wire #70/71 along side the GDE and the Exhalation assembly.
24. Disconnect wire #41 from the main power switch.
25. Connect wire #41 and #70/71 together as shown in photo #3
26. Connect wires #41 and #70/71 to the main power switch as shown in photo #3

NOTE

When connecting wires #41 and #70/71 press in on the main power switch from the outside of the unit to ensure that the main power switch is not pushed out. The secondary alarm assembly must be grounded to the unit chassis to ensure proper function.

27. Re-install the battery and fuse holder and re-connect the battery connector.

Functional testing of the Secondary Alarm Assembly.

Note

Do not install the base plate at this time.

1. Place and secure the pneumatic module to the cart.

Note

ensure that all wires and tube located in the lower section of the pneumatic module so damage does not occur.

2. Temporarily install the UIM onto the pneumatic module.
3. Connect the circuit and test lung to the pneumatic module for testing.
4. Plug AC power cord into appropriate wall supply.
5. If the unit does not have the on board compressor connect the unit to appropriate wall gas supply.
6. Turn unit on and allow the unit to power up and press accept patient icon.

7. Clear all visual and audible alarms.
8. Approximately 15 seconds after all alarms are cleared the Secondary alarm will sound for 1 to 2 seconds.
9. After 3 minutes with no backup alarm sounding from the unit, turn unit off.

Additional test to ensure proper wire routing.

1. This test requires quick action and response from the operator to ensure proper functional test of the Secondary alarm.
2. Disconnect expiratory sensor and turn unit ON. Disconnect speaker wire from J1 of the Secondary alarm P.C.B.A.
3. The secondary alarm must sound continuously approximately 20 seconds after wire is disconnected at J1
4. Reconnect speaker wire at J1 and secure all wires and tubes with cable ties as shown in photos #4 and #5.
5. Once the test has passed the bottom plate can be reattached and the unit can be placed back on the cart.

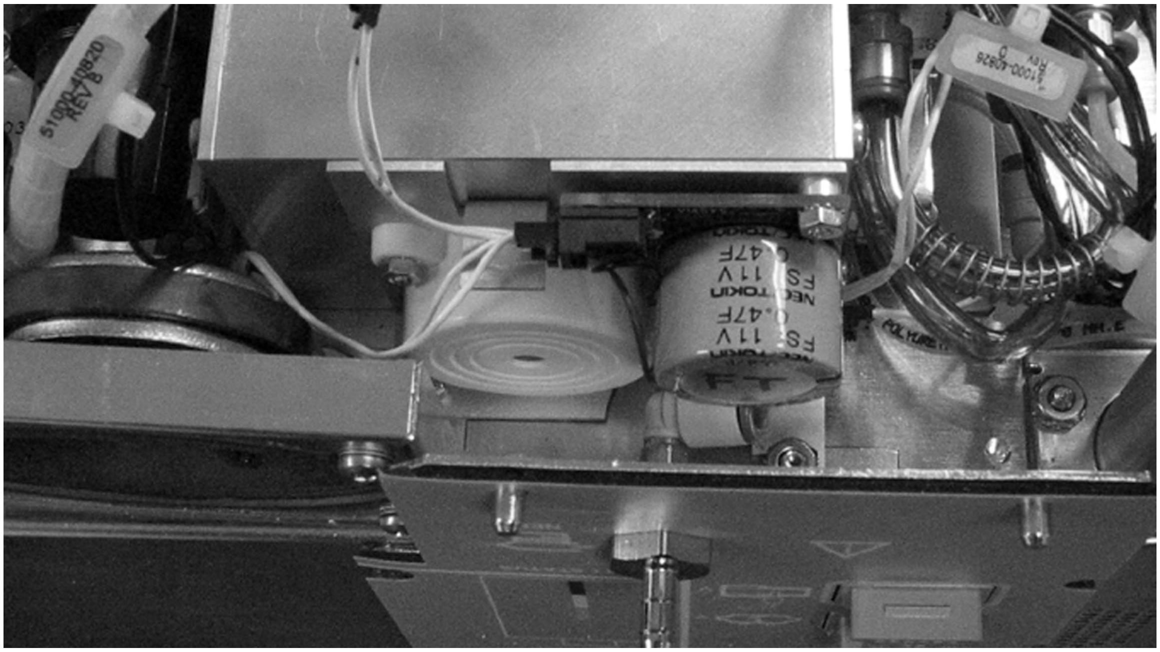


Photo #1

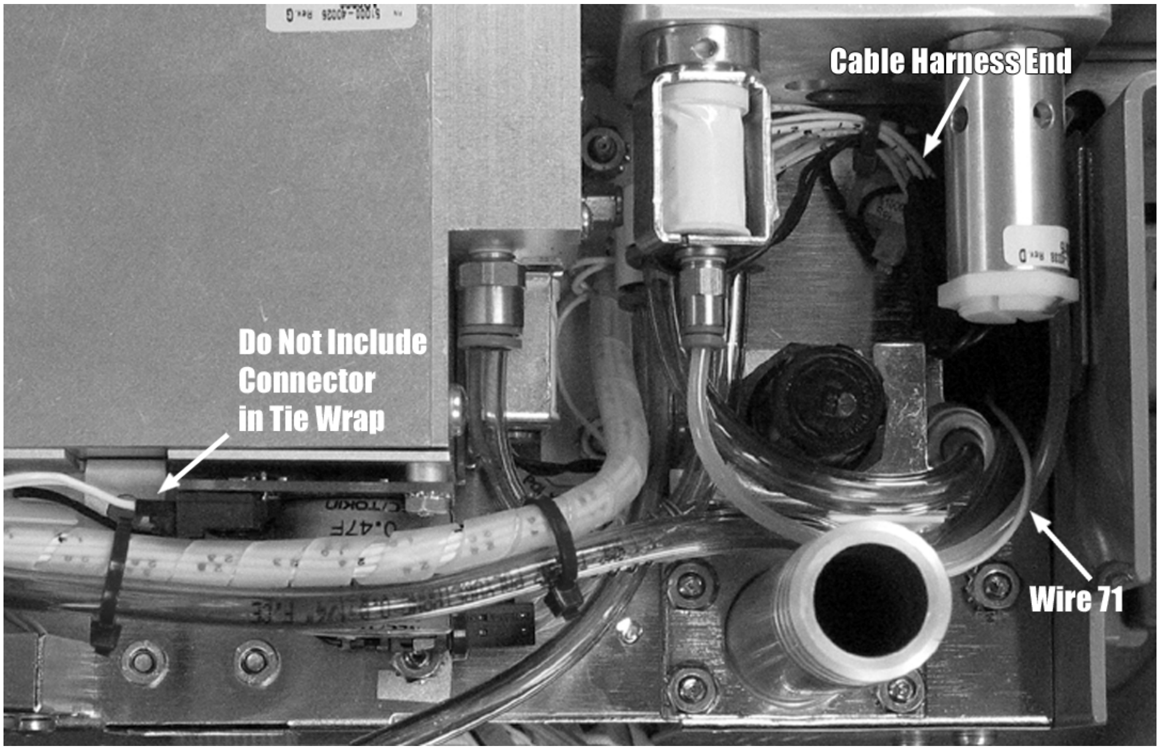

Cable Harness End
Do Not Include Connector in Tie Wrap
Wire 71

Photo #2

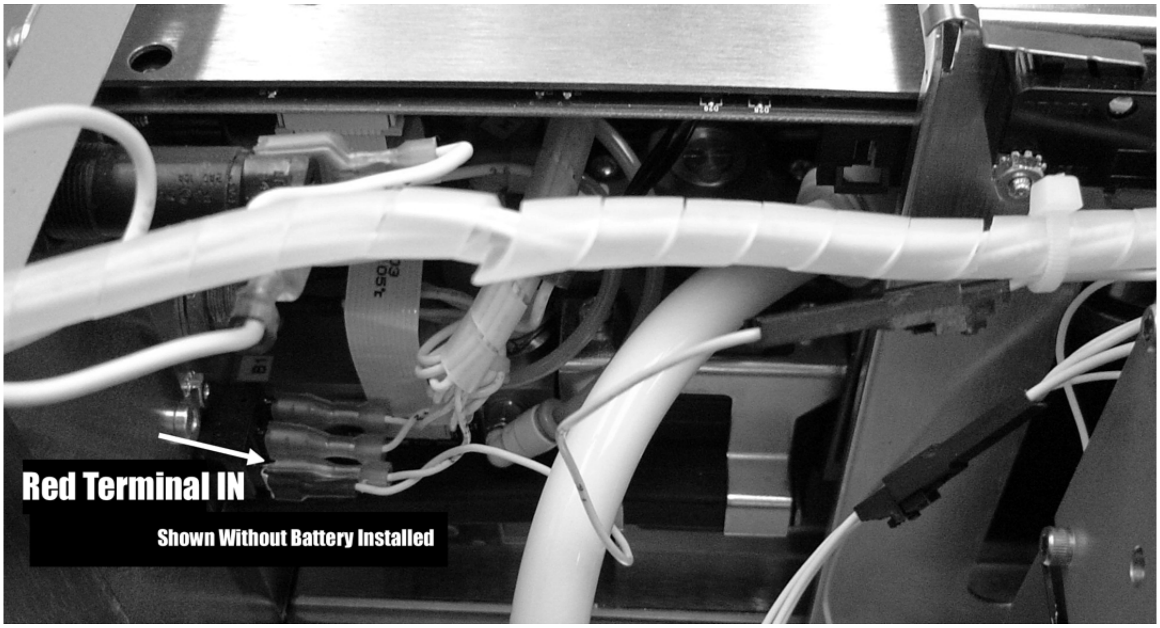
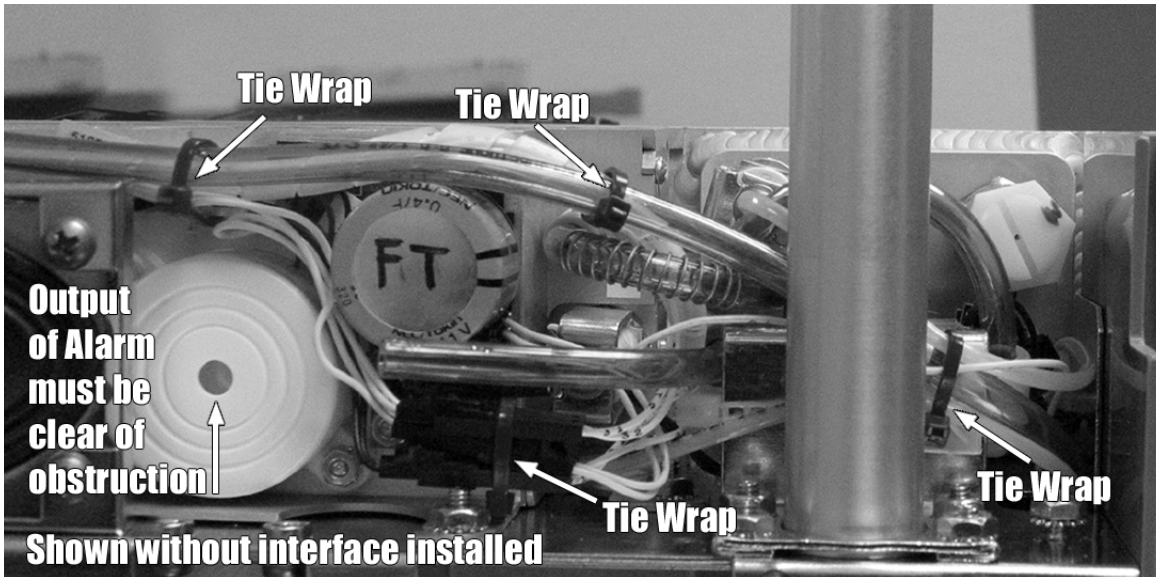

Red Terminal IN
Shown Without Battery Installed

Photo #3


Tie Wrap
Tie Wrap
Output of Alarm must be clear of obstruction
Tie Wrap
Tie Wrap
Shown without interface installed

Photo#4

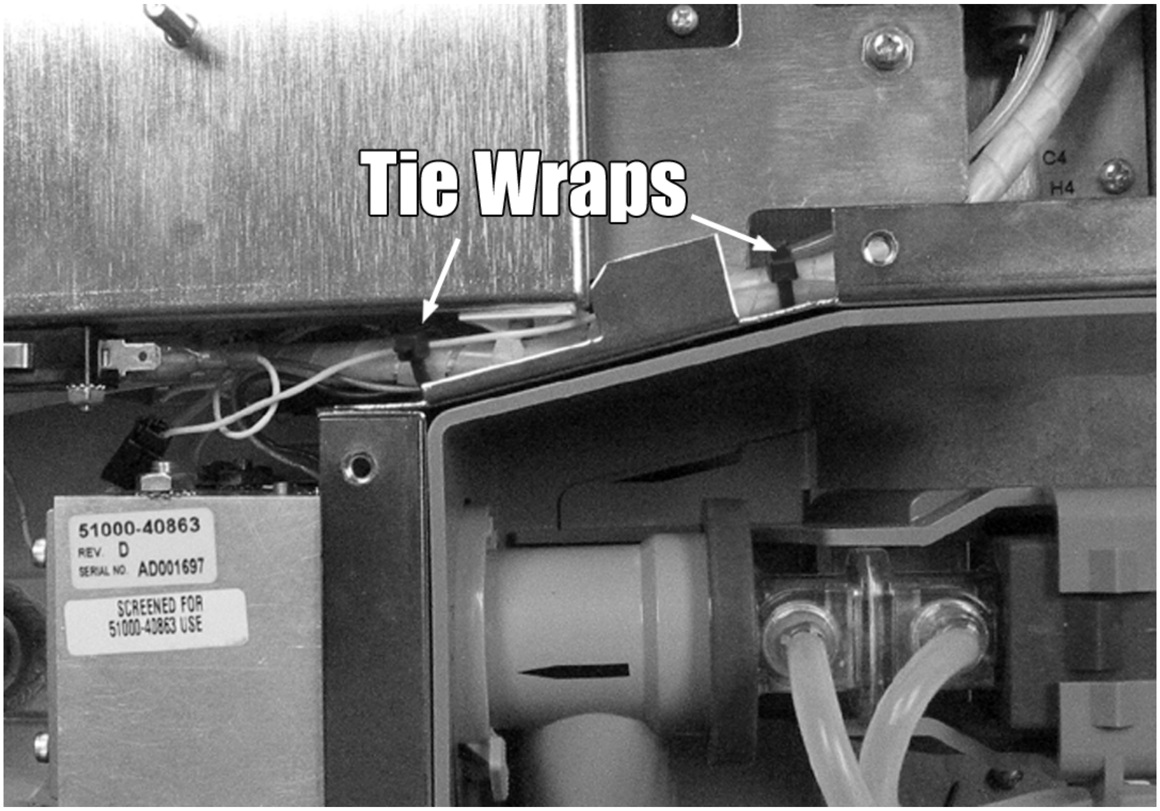

Tie Wraps
C4
H4
51000-40863
REV. D
SERIAL NO. AD001697
SCREENED FOR 51000-40863 USE

Photo #5

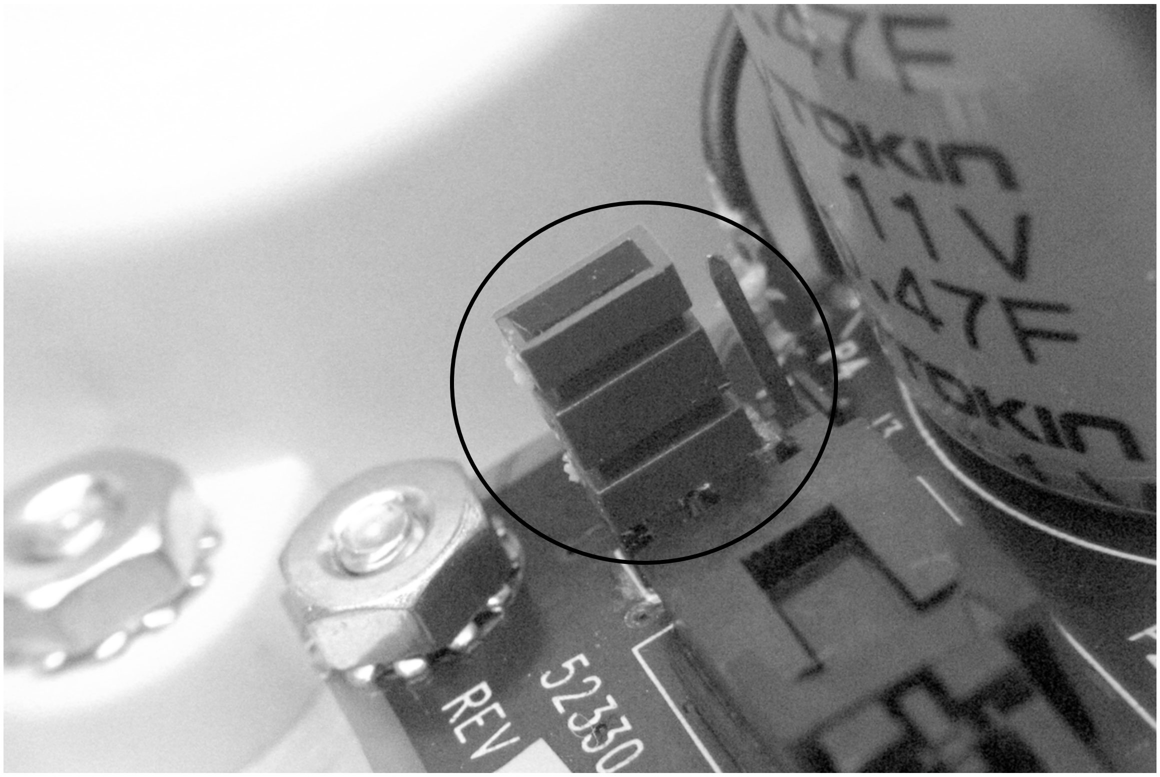

REV
52330
P4
J3
11V
.47F
TOKIN

Photo #6a Prior to ventilator serial # ADV03500

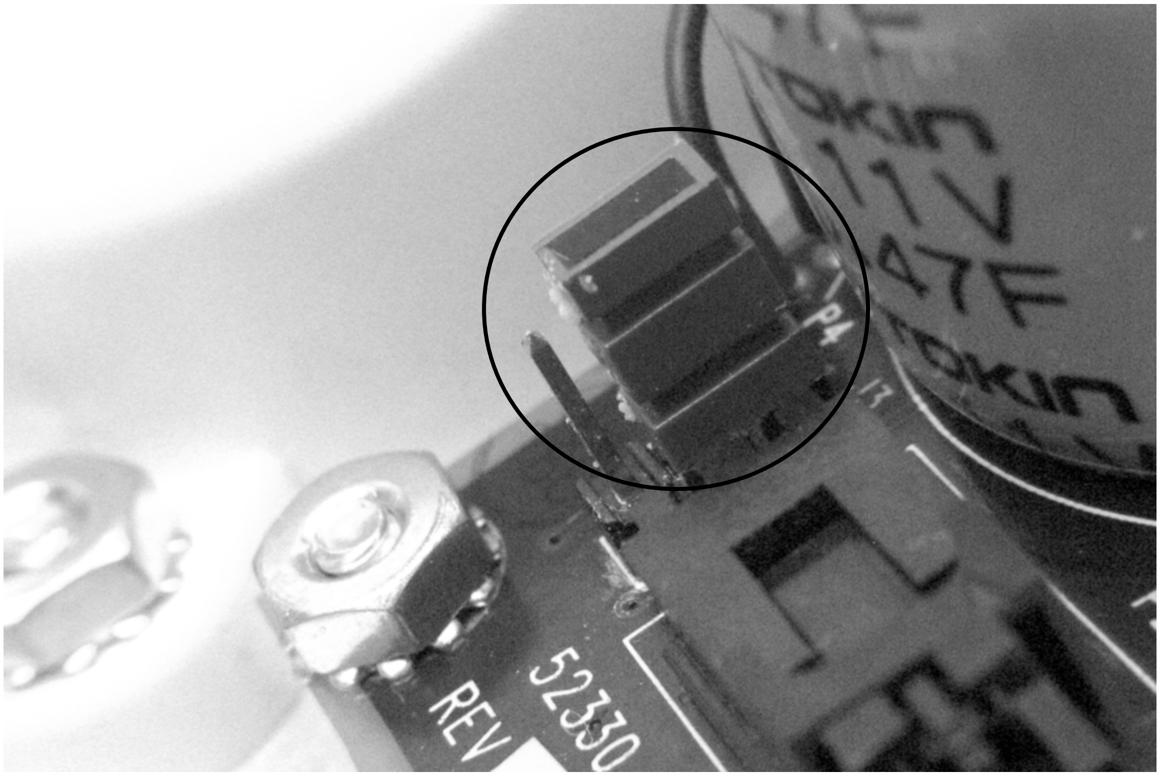

REV
52330
P4
J3
11V
.47F
TOKIN

Photo #6b After ventilator serial # ADV03500

Chapter 5 Operational Verification Procedure (OVP)

WARNING

Verification Testing should always be done off patient.

Set up

Plug the AVEA into a suitable AC Power source, 50 PSI oxygen source and 50 PSI medical air source. Initially, connect an adult patient circuit and an adult test lung.

NOTE

Manufacturer recommends the use of a non disposable adult patient circuit (P/N 16044 48" or P/N 16045 72") and test lung (P/N 33754) in testing VIASYS ventilation equipment:.

1 Turn power on.

2 Select *New Patient* when prompted. The *Safety Valve Open* alarm will activate. Press *Patient Accept*. (This will re-set the controls to the default settings shown at the end of this procedure).

3 Select *Patient Size* and select *Adult*. Press *Size Accept.* Leave the settings at the defaults and verify that a Vent-Inop. Alarm is not activated.

4 Ensure that *Leak Comp* and *Humidifier active* are off. Press *Setup Accept.*

User Verification Tests (UVT)

The following tests are part of the User Verification testing performed before connection to a new patient.

The POST test

The first part of the testing, the POST or Power On Self Test is transparent to the user and will only message if the ventilator encounters an error. This test is run automatically and performs the following checks:

- Processor Self Check
- ROM Check Sum
- RAM Test

The POST will also check the audible alarms and the LEDs at which time the audible alarm sounds and the LEDs on the User Interface Module flash. Normal ventilation commences at the culmination of the POST.

Extended Systems Test (EST)

Note: Ensure that the O2 alarm is enabled. The O2 sensor calibration portion of the EST will fail if the O2 alarm is disabled.

1 Connect medical grade oxygen and compressed air sources to the unit (20 TO 80 psi).

2 Press the Setup membrane button to access the Setup screen.

3 Press *Size Accept* to pass the next displayed screen.

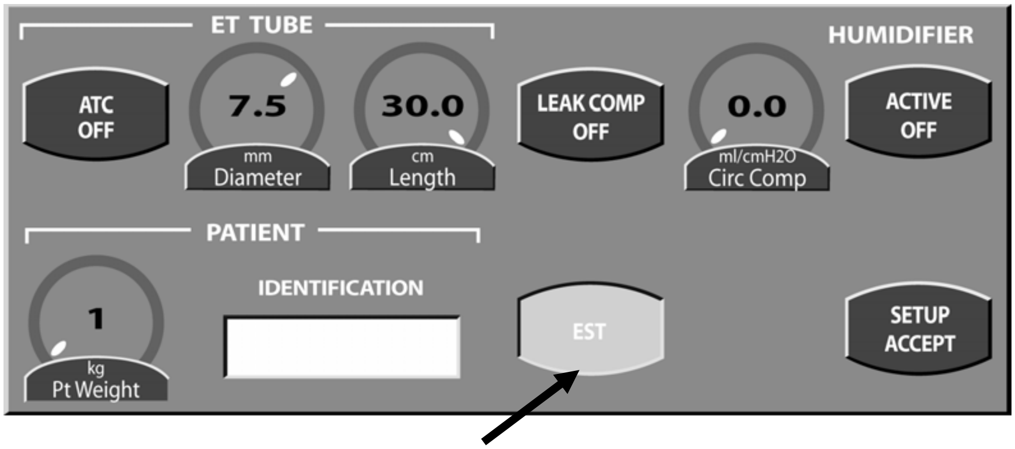
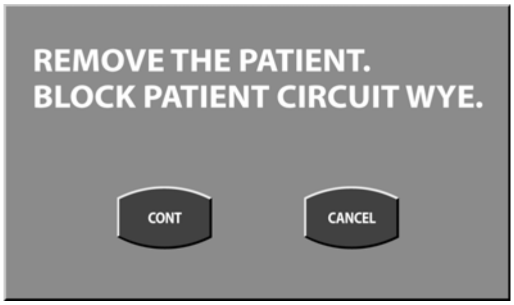

ET TUBE
HUMIDIFIER
ATC OFF
7.5
mm
Diameter
30.0
cm
Length
LEAK COMP OFF
0.0
ml/cmH2O
Circ Comp
ACTIVE OFF
PATIENT
1
kg
Pt Weight
IDENTIFICATION
EST
SETUP ACCEPT

Figure 5-1

4 Press the EST touch screen icon to highlight. (A message will appear instructing you to remove the patient and block the patient circuit wye.) Remove the test lung and plug the wye connector.

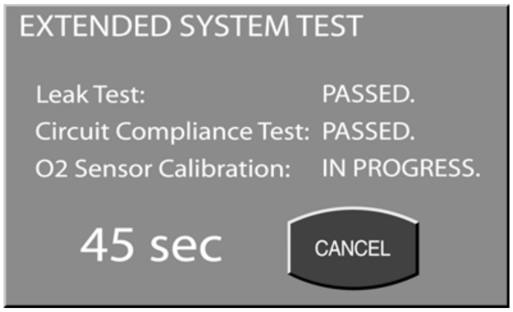


REMOVE THE PATIENT.
BLOCK PATIENT CIRCUIT WYE.

CONT
CANCEL

Figure 5-2

5 After confirming that the patient has been disconnected and the circuit wye blocked press the Continue (Cont) button. (The ventilator will perform the EST and display a countdown clock.)



EXTENDED SYSTEM TEST

Leak Test: PASSED.
Circuit Compliance Test: PASSED.
O2 Sensor Calibration: IN PROGRESS.

45 sec

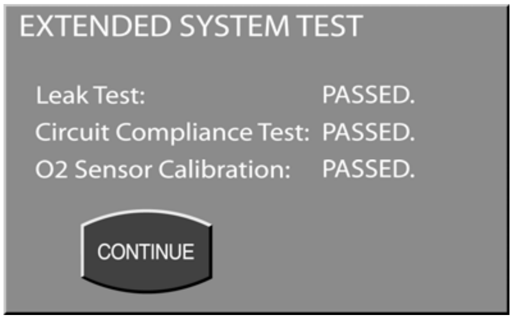
Figure 5-3

During this test the ventilator will perform:

- Patient circuit leak test
- Patient circuit compliance measurement
- Two point calibration of the oxygen sensor

The patient circuit compliance measurement and leak test are performed simultaneously with the oxygen sensor calibration. The maximum time for the EST is 90 seconds.

To restart the EST at any time select the Cancel button to return to the set up screen.



EXTENDED SYSTEM TEST

Leak Test: PASSED.
Circuit Compliance Test: PASSED.
O2 Sensor Calibration: PASSED.

Figure 5.4

After each test is complete the ventilator will display a “Passed” or “Failed” message next to the corresponding test.

Once the test is complete press the continue button to return to the set up screen.

Note

If you do not connect the ventilator to an oxygen supply, the O2 Sensor Calibration will immediately fail.

Manual Alarms Testing

This testing verifies the following alarms:

- Low PEEP alarm
- High Ppeak alarm
- High Ppeak,
- Low Ve alarm
- Loss of AC alarm
- High Ve alarm
- High Vt alarm
- Low Vt alarm
- Low O_2 alarm
- High O_2 alarm
- EXT High Ppeak alarm
- Low Ve alarm sensitivity
- Circuit Disconnect
- High Rate Alarm
- Apnea Interval Alarm

CAUTION

Although failure of any of the above tests will not prevent the ventilator from functioning, it should be checked to make sure it is operating correctly before use on a patient.

Note

To ensure proper calibration of the oxygen sensor, you should always perform a complete EST prior to conducting Manual Alarms Testing.

WARNING

User Verification Testing should always be done off patient.

CAUTION

Following each alarm verification test, ensure that the alarm limits are reset to the recommended levels shown in the following charts before proceeding to the next test.

Table 5-1 Test Setup Requirements

	Adult Setting	Pediatric Setting	Neonate Setting
Air Supply Pressure	20-80 psig (2.1 bar)	Same	Same
O2 Supply Pressure	20-80 psig (2.1 bar)	Same	Same
AC Line Voltage	Varies Internationally	Same	Same
Patient Circuit	6’ (2 m) Adult	6’ (2 m) Adult	Infant
Compliance	20 ml/cmH2O	20 ml/cmH2O	N/A
Resistance	5 cmH20/L/sec	5 cmH20/L/sec	N/A

To conduct Manual Alarms Testing on the AVEA ventilator using default settings, complete the following steps (A table describing the default settings for Adult, Pediatric and Neonatal patient sizes follows).

Please refer to software release notes of the current version of software in the AVEA that is being tested to obtain the specific default values. The ones listed in this manual are those for software version 3.4.

Table 5-2 Ventilation Setup

Vent Setup	Adult Setting	Pediatric Setting	Neonate Setting
ET tube Diameter	7.5 mm	5.5 mm	3.0 mm
ET Tube Length	30 cm	26 cm	15 cm
Artificial Airway Compensation	Off	Off	Off
Leak Compensation	Off	Off	Off
Circuit Compliance Compensation (Circ Comp)	0.0 ml/cmH2O	0.0 ml/cmH2O	0.0 ml/cmH2O NOT active in Neonates.
Humidification	Active On	Active On	Active On
Patient Weight	1 kg	1 kg	1 kg

Table 5-3 Primary Controls

	Adult Setting	Pediatric Setting	Neonate Setting
Breath Type/Mode	Volume A/C	Volume A/C	TCPL A/C
Breath Rate (Rate)	8 bpm	12 bpm	20 bpm
Tidal Volume (Volume)	500 ml	100 ml	2.0 ml in volume modes
Peak Flow	60 L/min	20 L/min	8 L/min
Inspiratory Pressure (Insp Pres)	15 cmH_2O	15 cmH_2O	15 cmH_2O
Inspiratory Pause (Insp Pause)	0.0 sec	0.0 sec	0.0 sec
Inspiratory Time (Insp Time)	1.0 sec	0.75 sec	0.35 sec
PSV	0 cmH_2O	0 cmH_2O	0 cmH_2O
PEEP	6 cmH_2O	6 cmH_2O	3 cmH_2O
Inspiratory Flow Trigger (Flow Trig)	1.0 L/min	1.0 L/min	0.5 L/min
$\%O_2$	21%	21%	21%

Table 5-4 Advanced Settings

Adv. Settings	Adult Setting	Pediatric Setting	Neonate Setting
Vsync	0 (off)	0 (off)	N/A
Vsync Rise	5	5	N/A
Sigh	0 (off)	0 (off)	N/A
Waveform	1 (Dec)	1 (Dec)	1 (Dec)
Bias Flow	2.0 L/min	2.0 L/min	2.0 L/min
Inspiratory Pressure Trigger (Pres Trig)	3.0 cmH_2O	3.0 cmH_2O	3.0 cmH_2O
PSV Rise	5	5	5
PSV Cycle	25%	25%	10%
PSV Tmax	5 sec	0.5 sec	0.35 sec
Machine Volume (Mach Vol)	0 L	0 ml	0 ml
Volume Limit (Vol Limit)	2.50 L	500 ml	300.0 ml
Inspiratory Rise (Insp Rise)	5	5	5
Flow Cycle	0% (off)	0% (off)	0% (off)
T High PSV	Off	Off	N/A

Adv. Settings	Adult Setting	Pediatric Setting	Neonate Setting
T High Sync	0%	0%	N/A
T Low Sync	0%	0%	N/A
Demand Flow	On	On	On

Table 5-5 Alarm Settings

	Adult Setting	Pediatric Setting	Neonate Setting
High Rate	75 bpm	75 bpm	75 bpm
High Tidal Volume (High Vt)	3.00 L	1000 ml	300 ml
Low Tidal Volume (Low Vt)	0.0 L	0.0 ml	0.0 ml
Low VTe Sensitivity	3 breaths	3 breaths	3 breaths
Low Exhaled Minute Volume (Low Ve)	1.0	0.5	0.05
High Exhaled Minute Volume (High Ve)	30.0 L/min	30.0 L/min	5.0 L/min
Low Inspiratory Pressure (Low Ppeak)	8 cmH_2O	8 cmH_2O	5 cmH_2O
High Inspiratory Pressure (High Ppeak)	40 cmH_2O	40 cmH_2O	30 cmH_2O
Low PEEP	3 cmH_2O	3 cmH_2O	1 cmH_2O
Apnea Interval	20 sec	20 sec	20 sec

Table 5-6 Auxiliary Controls

	Adult Setting	Pediatric Setting	Neonate Setting
Manual Breath	**---**	**---**	**---**
Suction	**---**	**---**	**---**
↑ O2	**79%**	**79%**	**20%**
Nebulizer	**---**		
Inspiratory Hold (Insp Hold)	**---**	**---**	**---**
Expiratory Hold (Exp Hold)	**---**	**---**	**---**

1. Make the appropriate connections for air and O2 gas supply. Connect the power cord to an appropriate AC outlet. Attach an appropriate size patient circuit and test lung to the ventilator.
2. Power up the ventilator and select “NEW PATIENT” when the Patient Select Screen appears. Accept this selection by pressing “PATIENT ACCEPT”. This will enable default settings for the Manual Alarms Test.
3. Select the appropriate patient size for your test (Adult, Pediatric or Neonate) from the Patient Size Select Screen. Accept this selection by pressing “SIZE ACCEPT”. Set *Humidifier Active* off.
4. Make any desired changes or entries to the Ventilation Setup Screen and accept these by pressing “SETUP ACCEPT”.
5. Press *Alarm Limits* button on the upper right of the user interface.
6. Verify that no alarms are active and clear the alarm indicator by pressing the alarm reset button on the upper right of the user interface.
7. Set the % O_2 control to 100%. Disconnect the Oxygen sensor from the back panel of the ventilator and verify that the Low O_2 alarm activates. Return the O_2 control setting to 21% with the sensor still disconnected from the rear panel. Remove sensor from back panel. Provide blow-by to the sensor from an external oxygen flow meter. Verify that the High O_2 alarm activates. Return the % O_2 to 21%, reconnect the Oxygen sensor to the back panel. Clear all alarm messages by pressing the alarm reset button.
8. Set *PEEP* to 0. Set *Low PEEP* alarm to 0. Disconnect the patient wye from the test lung. Verify that the Low Ppeak alarm activates, followed by the Circuit Disconnect alarm. This second alarm should activate after the default setting of 20 seconds for the apnea interval has elapsed. Reconnect the test lung to the circuit clear the alarm by pressing the reset button.
9. Disconnect the AC power cord from the wall outlet. Verify that the Loss of AC alarm activates and the battery-back up symbol appears in the lower right hand corner of the UIM touch screen. Reconnect the AC power cord. The “battery” symbol should disappear. Clear the alarm by pressing the reset button.
10. Occlude the exhalation exhaust port. Verify that the High Ppeak alarm activates, followed 5 seconds later by the activation of the High Ppeak, Sust. alarm.
11. Set the control setting for rate to 1 bpm. Verify that Apnea Interval alarm activates after the default setting of 20 seconds. Return the control setting to its default value and clear the alarm by pressing the reset button. Note that nebulizer is inactive with infant patient size selected.
12. Set the Low PEEP alarm setting to a value above the default control setting for PEEP on your ventilator. Verify that the Low PEEP alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.
13. 13.Set the High Ppeak alarm setting to a value below the measured peak pressure or in neonatal ventilation, the default control setting for Inspiratory Pressure on your ventilator. Verify that the High Ppeak alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.
14. 14.Set the Low Ve alarm setting to a value above the measured Ve on your ventilator. Verify that the Low Ve alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.
15. 15.Set the High Ve alarm setting to a value below the measured Ve on your ventilator. Verify that the High Ve alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.

16. Set the High Vt alarm setting to a value below the set Vt on your ventilator. Verify that the High Vt alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.
17. Set the Low Vt alarm setting to a value above the set Vt on your ventilator. Verify that the Low Vt alarm activates. Return the alarm setting to its default value and clear the alarm by pressing the reset button.
18. Set the number of consecutive breaths with an exhaled tidal volume below the Low Vte Alarm setting which are required to sound the alarm. Verify that this set number of breaths is at Low Vte prior to alarm sounding. Default is 3 breaths.
19. Set the High Rate alarm to a value below the default control setting for rate on your ventilator. Verify that the alarm activates. Return the alarm to its default setting and clear the alarm by pressing the reset button.
20. Verification of Circuit Disconnect Alarm. Add a proximal (wye) flow sensor to an infant or pediatric patient set-up. Create a leak. When the Percent Leak ((Vti-Vte)/Vti) becomes 95% or greater for three consecutive breaths, the alarm should sound. Without a proximal flow sensor, the threshold becomes 90% leak.
21. Verification of Circuit Occlusion Alarm: This alarm occurs due to excessive resistance in the patient circuit. The Circuit Occlusion Alarm will sound if the inspiratory pressure exceeds the expiratory pressure by greater than 6 cmH2O for more than 200 msec. This may be tested by creating increased resistance on either limb of the patient circuit. Note: During adult applications, the alarm is suspended during the first 150msec of exhalation.

NOTE

Repeat steps 11 through 21 in Pediatric Mode with a pediatric circuit and Siemens or Manley test lung.
Repeat steps 11 through 21 in Infant Mode with an infant circuit and an Ingmar or other suitable infant test lung.

CAUTION

Although failure of any of the above tests will not prevent the ventilator from functioning, it should be checked to make sure it is operating correctly before use on a patient.

Tidal Volume Accuracy Verification

Volume Definitions

V del: V del is the total volume delivered by the machine. This value will be greater than the VT i if tubing compliance is set. It is measured by the inspiratory flow sensor inside the ventilator.

VT i: Inspired tidal volume. VT i is measured by the Inspiratory flow sensor inside the ventilator and reflects the volume without compensating for tubing compliance.

VT e: Exhaled tidal volume. Exhaled volume readings are measured by the expiratory flow sensor. This reading may be affected by the humidifier setting.

VT set: The tidal volume set by the clinician.

Testing Guidelines

Use default parameters for each patient size group; adult, pediatric and infant

Refer to table 5.1: Test Setup Requirements and 5.2: Ventilation Setup

Primary Control VT defaults are as follows:

Adult 500 ml.

Pediatric 100 ml.

Change Neonate to Volume A/C and enter a VT of 20 ml.

Use appropriate circuit and test lung for each patient group. It is suggested that when performing VT verification in adult and pediatric ranges, a Manley test lung is used. When using a Seimens test lung, the test is to be performed without the proximal sensor.

Ensure that circuit compliance, artificial airway compensation, leak compensation and humifier are off.

Select ATPD Flow Correction

Do not use a flow sensor.

Accuracy of displayed exhaled volume is + or – 0.2 ml. plus 10% of set VT.

Table 5-7 VT Tolerance Ranges

VT SET	VT EXHALED
1000	900 to 1100 ml. +/- 0.2 ml.
500	450 to 550 ml. +/- 0.2 ml.
100	90 to 110 ml. +/- 0.2 ml.
20	18 to 22 ml. +/- 0.2 ml.

Return Flow Correction to BTPS upon completion of testing.

User Interface Module (UIM) Verification

Membrane Switch Tests

These tests verify the functioning of the membrane buttons surrounding the touch screen:

1. Alarm Silence (LED) - Disconnect the test lung from patient circuit. An audible alarm sounds. Press the Alarm Silence button and verify that the audible portion of the alarm is disabled for 2 minutes (± 1 second)or until the Alarm Silence button is pressed again.
2. Alarm Reset - Reconnect the test lung to the patient circuit. The alarm message should turn yellow. Press the Reset button to cancel the visual alarm message.
3. Alarm Limits - Press the Alarm Limits screen button. Press the button again to toggle the screen on and off.
4. Manual Breath - Press this button during the expiration phase of a breath. Verify that the ventilator delivers a single mandatory breath at current ventilator settings.

5. Suction (LED) - Press the Suction button, both Suction and ↑ %O_2 LEDs should Illuminate, also LOSS, O2 appears on the screen in the alarm window. Press Suction again, both Suction and ↑ %O_2 LEDs should disappear, press Reset to clear visual alarm.
6. Increase O2 - Press the Increase O2 button (↑ %O_2) Verify that the LED Illuminates, The LOSS O2 alarm activates. Press the button again and verify that the LED turns off. Press RESET to clear the visual alarm.
7. Accept - Change any parameters, press accept and verify the new setting is entered.
8. Cancel - Change any parameters, press Cancel ensure new setting is canceled.
9. Expiratory Hold - Press the Expiratory Hold button. The pressure waveform should display as a flat line for about 20 seconds in Adult and Pediatric Patient modes.
10. Inspiratory Hold - Allow to cycle then press this soft key & it will plateau at the top of the inspiratory cycle in the adult and pediatric patient modes.
11. Nebulizer - Connect wall air to unit 20 to 80 psi. Press the Nebulizer button, verify that nebulization is synchronized with breath rate. You will feel air coming out of the nebulizer fitting. Lower peak flow < 14L/min and “neb not available” should appear.
12. Mode - Press the Mode button. Verify that the Mode sub screen appears.
13. Patient Size - Select a Patient size from the menu. Ensure the correct LED is displayed for the patient size currently selected. Change patient size to Pediatric and then to Neonate. Verify correct LED display for each one.
14. Panel Lock - Press the Lock button and verify no access to screen functions. The manual breath, suction, increase O2 and alarm silence buttons are functional during panel lock.
15. Set-up - Press the Setup button and verify that the Setup screens appears. Press Size Accept, Press Set up Accept.
16. Advanced Settings - Press the Advanced Settings screen button. Toggle the screen on & off. Verify that the screen responds correctly.
17. Event - Press Events and verify the sub screen appears, press again to check that the Main screen reappears.
18. Freeze - Press the Freeze button. All graphics screen update should cease, the wave forms freeze. Measurement bar appears. Press again and ensure normal refresh of the waveform sweep continues in the Main screen.
22. Screens and Main buttons - Press the Screens button and the Screen Select screen should appear. Press Monitor, the Monitor screen should display. Press Main and the screen should go back to Main screen.

AVEA Assembly and Operational Verification Test Checklist

This is a checklist ONLY. Please refer to detailed Installation, Assembly and OVP Instructions.

Unit Serial Number: ____________UIM SerialNumber: ___________

Hours___________Software Revision___________Other________________

If any parts are missing contact VIASYS AVEA Customer Service at 800-325-0082 or 760-883-7185.

Field replacement and test of the AVEA Compressor Assembly

Refer to this chapter for disassembly of the User Interface Module (UIM) and top cover. Follow the instructions given in Chapter 4 to remove and replace the compressor assembly. Re-assemble the AVEA and test using this procedure.

The compressor sub-system on the AVEA includes a Compressor PC Board and the Compressor. The sub-assembly is tested and calibrated at the factory and designed to be field installed in the AVEA ventilator. This procedure verifies that the test ventilator delivers the expected minute ventilation when the compressor is supplying air to the ventilator (40 L/min). It also verifies that the compressor activates upon loss of the wall air supply and de-activates when that supply is restored.

Equipment Required

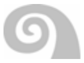
- •AVEA Ventilator (Test ventilator)
- •Adult Patient Circuit
- •Adult Test Lung – Manley or Siemens recommended
- •Regulated Air Supply - Range > 30 psig

Note

All equipment is as stated or equivalent .

Compressor Check

1. Ensure a regulated wall air supply is on prior to start of test.
2. Attach an adult patient circuit and test lung to the test ventilator.
3. Turn on the ventilator and leave on adult default parameters.
4. Turn off the wall air supply.
5. Verify that the compressor activates at approximately 18-20 PSI.



6. Verify that the “scroll” symbol is displayed in the bottom right corner of the UIM.
7. Verify ventilator continues to ventilate and no alarms are activated.
8. Allow ventilator to continue to cycle using the compressor for approximately two minutes.
9. Disconnect the expiratory limb of circuit. Verify High Priority alarms activate..
10. Reconnect circuit and test lung.
11. Change the following ventilator settings:

Control	**Setting**
Tidal Volume (Vt)	2.0L,
Rate	19 bpm,
Peak Flow	150 L/MIN.

12. Change the scale on Flow waveform graphic display to 300 L/min.
13. Press the Freeze button.
14. Verify the flow at the end of inspiration is 135 L/min . or greater..
15. Re-connect wall air supply.
16. Verify compressor shuts off and ventilation continues uninterrupted using the wall air supply.

Table 5-8 Test Ventilator: (AVEA Ventilator)

Setup	Patient Size	Adult
	ET Tube Diameter	7.5 mm
	ET Tube Length	30 cm
	Automatic Tube Compensation (ATC)	Off
	Leak Compensation	Off
	Circuit Compliance Compensation (Circ Comp)	0.0 mL/cmH2O
	Humidification	Off
	Ideal Body Weight	1 Kg
	Barometric Pressure	Accurate/current reading
Primary Controls	Breath Type/Mode	Volume A/C
	Breath Rate (Rate)	15
	BPM	
	Tidal Volume (Volume)	0.50 L
	Peak Flow	45 L/MIN
	Inspiratory Pause (Insp Pause)	0.00 second
	Inspiratory Time (I-Time)	- - -
	PSV	- - -
	PEEP	0 cmH2O
	Inspiratory Flow Trigger (Flow Trig)	20.0 L/MIN
	% O2	21 %

Advanced Controls	Vsync	0 (Off)
	Vsync Rise	- - -
	Sigh	0 (Off)
	Waveform	Square
	Bias Flow	2.0 L/MIN
	Inspiratory Pressure Trigger (Pres Trig)	20.0 cmH2O
	PSV Rise	- - -
	PSV Cycle	- - -
	PSV T_{max}	- - -
	Machine Volume (Mach Vol)	- - -
	Volume Limit (Vol Limit)	- - -
	Inspiratory Rise (Insp Rise)	- - -
	Flow Cycle	- - -
Alarm Settings	High Rate	200 BPM
	High Tidal Volume (High Vt)	3.00 L
	Low Exhaled Minute Volume (Low Ve)	0 (Off)
	High Exhaled Minute Volume (High Ve)	30.00 L/MIN
	Low Inspiratory Pressure (Low PPEAK)	3 cmH2O
	High Inspiratory Pressure (High PPEAK)	50 cmH2O
	Low PEEP	0 cmH2O
	Apnea Interval	20 seconds
Auxiliary Controls	Manual Breath	- - -
	Suction	- - -
	[a] %O2	Not enabled
	Nebulizer	Not enabled
	Inspiratory Hold (Insp Hold)	- - -
	Expiratory Hold (Exp Hold)	- - -
	Air Supply Pressure	> 30 psig
	O2 Supply Pressure	> 30 psig
	AC Line Voltage	115 ± 10 VAC

Checkout Sheet – AVEA Compressor Replacement

Date: _______________ Hours: __________

Old Compressor S/N: ____________ New Compressor S/N: ________________

AVEA Ventilator S/N: _____________ UIM Serial Number: __________________

TEST	PASS FAIL	
Compressor Activates when wall air is turned off		
Scroll symbol displays when compressor activates		
Ventilator continues to cycle and no alarms initiate when wall air is turned off		
Circuit Disconnect and High Priority alarms initiate when circuit is disconnected		
End inspiration flow reading is 135 L/min or greater		
Compressor shuts off when wall air is turned on and ventilation continues uninterrupted		

I here by certify that the product with the above Serial Number has passed all operational specification and is certified for clinical use (The unit must be signed off before returning to clinical use.)

Signature: ______________________________ Date: ______________

Please complete this check sheet and FAX to VIASYS Technical Support at (714) 283-8471.

Power Indicators and Charging Verification.

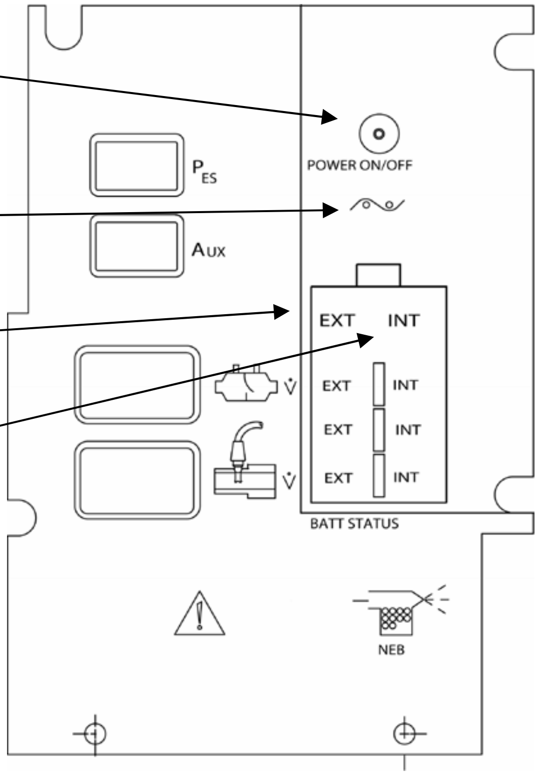


Figure 5.5

Power the unit up. Verify the Power On indicator is lit. It will be green.

Ensure that when the unit is connected to AC Power the AC indicator is lit. It will be green.

If the unit is equipped with an external battery, check and verify the external battery charging and status indicators.

Check the internal battery (standard feature) charging and status indicators.

The charging status indicators are:

Green: (80% or more charge remaining for external battery, 90% or more charge remaining for the internal battery).

Yellow: (Less than 80% for external battery, less than 90% for the internal battery)

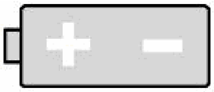
Red: (Less than 40% for external battery, less than 30% for the internal battery)

Proceed with the rest of the O.V.P testing.

Battery Run Procedure

1. Plug unit in, turn power on and adjust settings as follows:
    a. *Mode*: Pediatric, Volume A/C
    b. *Settings:* 40 BPM, Volume 200ml, Peak Flow 30 L/min, PEEP 5cmH2O, Flow Trigger 20 L/min, and FIO2 21%.
    c. *Advanced Settings:* Vsync off, Waveform Square, Bias Flow 3 L/min, and Pressure Trigger 20cmH2O.
2. Verify that the Power Indicator “EXT” is illuminated and the Power Status is on AC (~).
3. Verify battery indicator LED’s function and progressively charge from Red to Yellow to Green.
4. Disconnect A/C power to verify external batteries. The Power status indicator “EXT” should be illuminated indicating that ventilator is running on the external batteries.

5. Verify internal batteries. Disconnect external batteries. Verify that the power status indicator “INT” is illuminated and the unit continues to run without interruption. Verify that the “on screen” battery indicator is displayed.



6. Turn unit off.

Air/Oxygen Inlet Pressure Verification.

Note

All gases used for testing the AVEA should be verified clean medical grade gas sources. The ventilator should be operating in Adult patient mode with all settings at defaults.

1. Apply a regulated 50 PSI medical air source to the AVEA Air Inlet on the rear panel of the ventilator.
2. Apply regulated 50 PSI medical O2 Source to the O2 Inlet. (Verify the Air and O2 Inlet monitors read 50 PSI (+/- 3 PSIG). You can check this by scrolling to the air inlet and O2 inlet monitored parameter displays on the left of the Main screen

or by pressing the screens button, selecting the Monitor screen and scrolling to the air inlet and O2 inlet parameters and *Accept.*

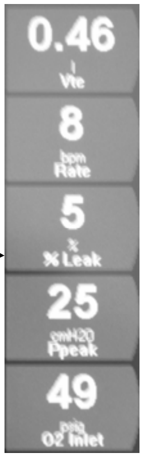


Figure 5.6

3. Lower the air inlet pressure gage to 18 psi. The compressor should turn on in a unit with compressor. In a unit with no compressor, the Low Air alarm should activate.

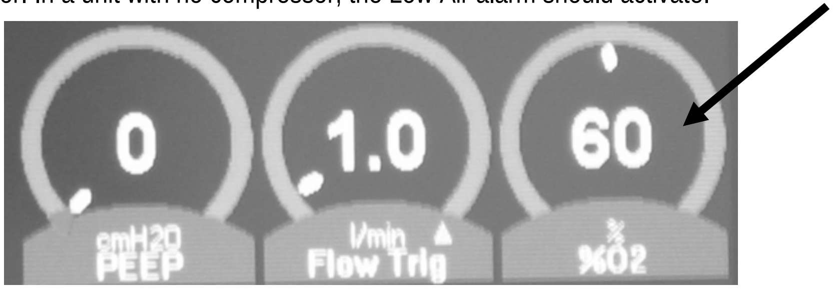


Figure 5.7

4. Change the O2 percentage to 60%.

5. Lower the O2 inlet pressure gage to 18 psi. The Low O2 alarm should activate.

Breath Rate Verification.

Note

Make sure the ventilator is set to Adult size and default settings.

1. Allow the ventilator to cycle and using a stopwatch, count the cycles and ensure the breath rate matches the Rate setting of the AVEA.
2. Verify the following rates(+/- 2)

   5 bpm

   20 bpm

   60 bpm

Blending Accuracy Verification.

Note

Make sure the ventilator is set to Adult size and default settings.

Record the readings from the external O2 Analyzer and the AVEA FIO2 (% O2) monitor/setting. Check the FiO2 (% O2) readings per table below to compare set FIO2 to analyzed FIO2.

Table 5.9: FiO2 Readings

O2%	Tidal Volume	Breath Rate	Peak Flow	% Tolerance
21%	0.50L	25	30 L/min	+/- 1%
30%	0.10	50	30 L/min	+/- 3%
30%	0.50	25	30 L/min	+/- 3%
60%	0.10	50	30 L/min	+/- 3%
60%	0.50	25	100 L/min	+/- 3%
90%	0.10	50	30 L/min	+/- 3%
90%	0.50	25	30 L/min	+/- 3%
100%	0.50	25	30 L/min	+/- 3%

PEEP Verification

1. Connect an Adult test lung and accept the default settings.
2. Change the Rate to 4 bpm. Using the Paw (cmH2O) portion of the wave form screen, freeze and measure baseline pressures at each of the following PEEP settings: (The tolerance is +/- 3.5 % of reading or +/- 2 cm.) Compare to digital monitored reading.

   6 cm

   20 cm

   40 cm

AVEA Assembly and Operational Verification Test Checklist

This is a checklist ONLY. Please refer to detailed Installation, Assembly and OVP Instructions.

Unit Serial Number: ____________UIM SerialNumber: ___________

Hours___________Software Revision___________Other________________

If any parts are missing contact VIASYS AVEA Customer Service at 1-800-231-2466.

ASSEMBLY	COMPLETED	
Stand Assembly		
External Battery Installation		
"E" Cylinder Bracket Assembly		
Unpacking and Mounting the AvEA		
Installation of Medical Gas Connector(s)		
Exhalation Filter and Water Trap Assembly		
TESTS	**PASS**	**FAIL**
User Verification Tests (UVT)		
POST Test		
Extended Systems Test (EST)		
Manual Alarms Testing		
Adult		
Pediatric		
Infant		
VT Accuracy Verification		
UIM (User Interface Module) Membrane Switch Tests		
Compressor Check		
Power Indicators and Charging Verification		
Battery Test: Battery Run Procedure		
Air/Oxygen Inlet Pressure Verification		
Breath Rate Verification		
Blending Accuracy Verification		
PEEP Verification		

WARNING

Verification Testing should always be done off patient.

Checklist completed by________________________

Signature______________________Title_________________________

Facility_____________________________

Chapter 6 AVEA Software Upgrade

This document provides a brief overview of the procedure to upgrade ventilator software using the RS232 serial port of the AVEA. The HyperTerminal utility available within the Windows environment is used here as an example. Any suitable terminal emulation software would work as well.

Requirements:

- Computer with a serial port (COM1: or COM2:)
- Terminal Emulation Software (for example, HyperTerminal works well) configured for serial connection 115Kb,8,N,1 flow control OFF (see instructions below)
- AVEA ventilator with Software Upgrade Utility Version 3.0 or higher installed.
- A Serial cable to connect the computer to the serial port of the ventilator.
  (A straight-through cable with null modem adapter or null modem cable with gender changer both work fine).
- New binary files for the ventilator: 63603X.bin (Monitor) and 63602X.bin (Control). “X" indicates the revision of the released software in alphabetic characters e.g. "63603F" is revision F.

Upgrading software to 3.3 or below:

- AVEA ventilator with Software Upgrade Utility Version 1.0 or higher installed.
- New binary files for the ventilator: 63603X.bin (Monitor) and 63602X.bin (Control).

Upgrading software to version 3.4 or above:

- AVEA ventilator with Software Upgrade Utility Version 3.0 or higher installed.
- Binary files for the ventilator target specific language groups.
    - Group A (P/N 16402-X.bin (Control) and 16403-X.bin (Monitor):
        - English
        - Francais (French)
        - Deutsch (German)
        - Italiano (Italian)
        - Portugues (Portuguese)
        - Espanol (Spanish)
        - (Chinese)
        - Nederlands (Dutch)

Procedure:

1. Copy the files to the desktop

From a CD

With the CD inserted in the computer, copy the new software binary files(see requirements section) to the computer hard drive as follows:

- Double click on "My Computer".
- Double click on the CD ROM Drive to open the window & display the files.
- Right click on each of the files displayed in turn and select Copy, then right click on the computer desktop and select Paste.
- The files should appear on the desktop.

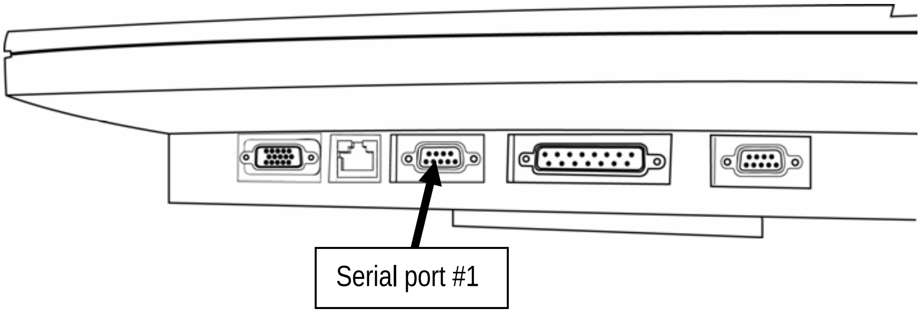
Remove the CD ROM from the computer drive.

From an e-mail attachment

- Right click on the e-mail attachment. From the pop-up dialog box select Save As.
- Browse to your desktop and click Save.
- The files should appear on the desktop.

2. Connect the AVEA

Connect the serial cable to the computer COM port selected for use (usually Com1 or Com2). Connect the other end to the ventilator serial port 1 shown here.

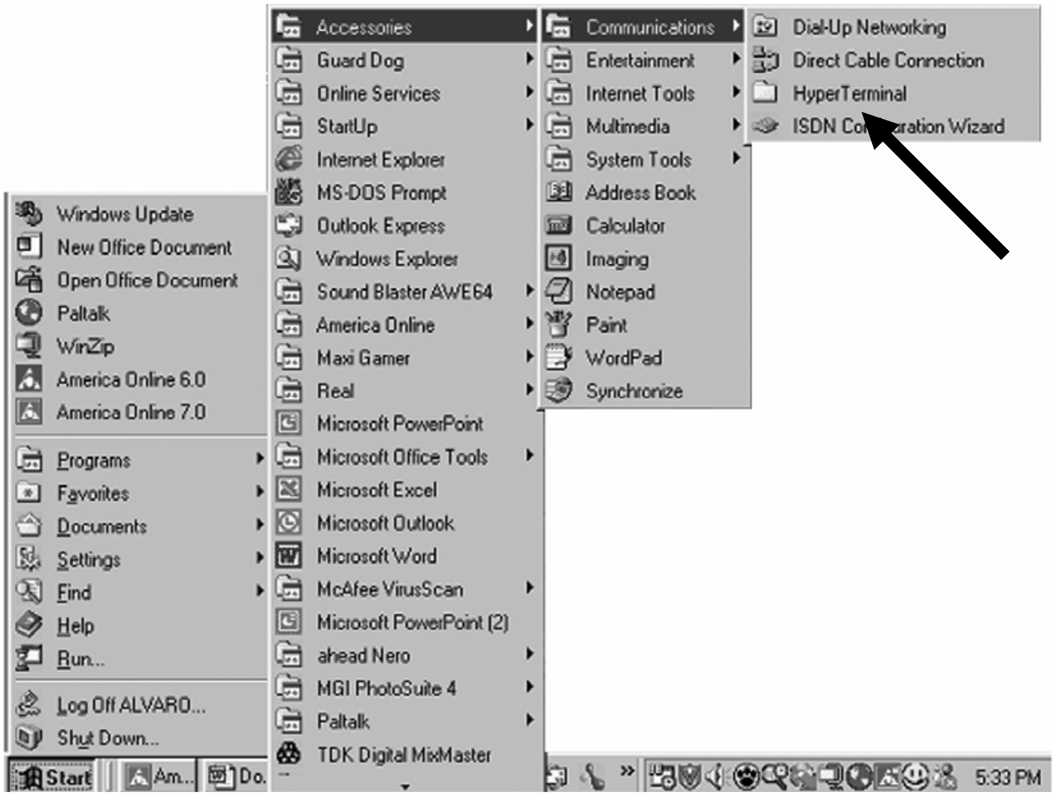


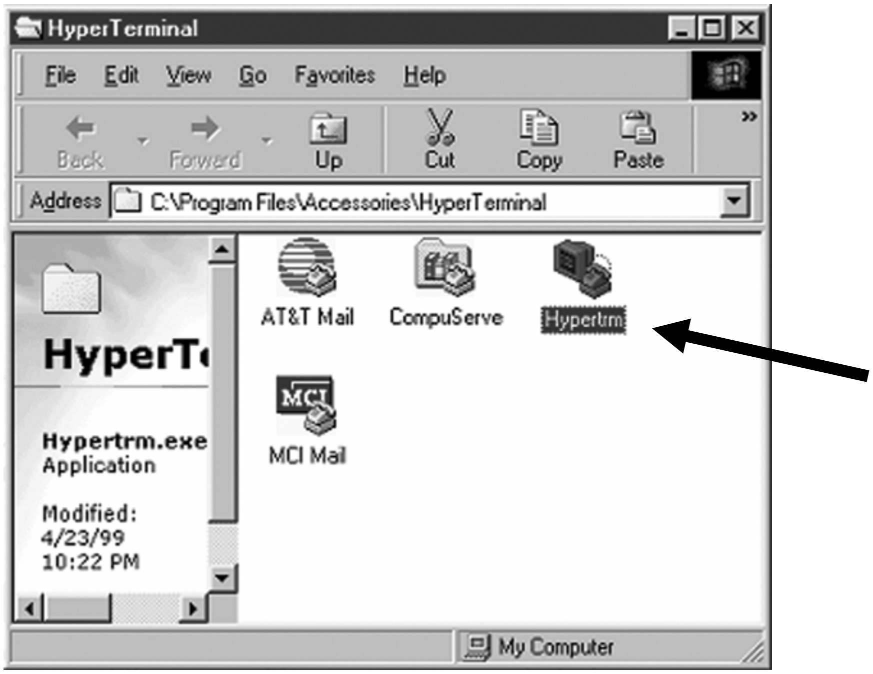
3. Open terminal emulation software (HyperTerminal is used here)

NOTE: Be aware that the version information and possibly the binary file name may be different for your situation.

From your desktop, click on the START button at the lower left of the screen.

From the pop-up menu, select Programs, then Accessories, then Communications.When the Communications pop-up appears, click on Hyper Terminal.


Windows Update
New Office Document
Open Office Document
Paltalk
WinZip
America Online 6.0
America Online 7.0
Programs
Favorites
Documents
Settings
Find
Help
Run...
Log Off ALVARO...
Shut Down...
Start
Am...
Do...
Accessories
Guard Dog
Online Services
StartUp
Internet Explorer
MS-DOS Prompt
Outlook Express
Windows Explorer
Sound Blaster AWE64
America Online
Maxi Gamer
Real
Microsoft PowerPoint
Microsoft Office Tools
Microsoft Excel
Microsoft Outlook
Microsoft Word
McAfee VirusScan
Microsoft PowerPoint (2)
ahead Nero
MGI PhotoSuite 4
Paltalk
TDK Digital MixMaster
Communications
Entertainment
Internet Tools
Multimedia
System Tools
Address Book
Calculator
Imaging
Notepad
Paint
WordPad
Synchronize
Dial-Up Networking
Direct Cable Connection
HyperTerminal
ISDN Configuration Wizard
5:33 PM


HyperTerminal
File
Edit
View
Go
Favorites
Help
Back
Forward
Up
Cut
Copy
Paste
Address
AT&T Mail
CompuServe
Hypertrm
MCI Mail
My Computer

Address: C:\Program Files\Accessories\HyperTerminal

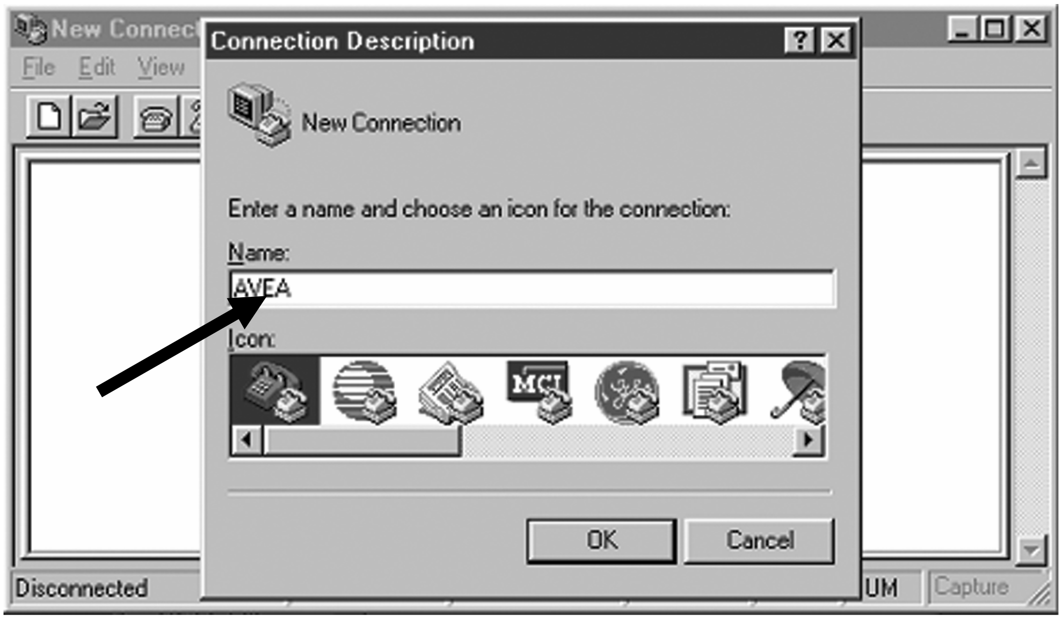
HyperTe

Hypertrm.exe
Application

Modified:
4/23/99
10:22 PM

Double-click the HyperTerminal icon inside the HyperTerminal folder.

The HyperTerminal window opens in the New Connection window.


New Connect
File Edit View
OK
Cancel
Disconnected
UM
Capture

Connection Description

New Connection

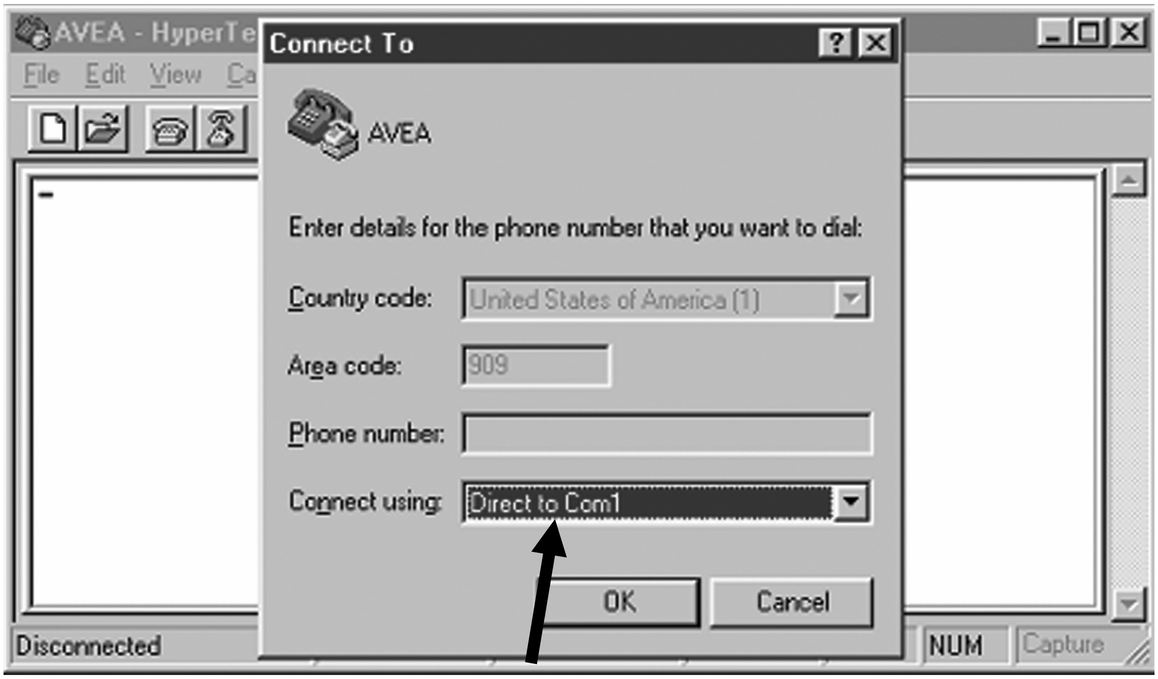
Enter a name and choose an icon for the connection:

Name: AVEA

Icon:

Type AVEA into the Name bar and click OK.

The Connectivity window opens


AVEA - HyperTe
File Edit View Ca
OK
Cancel
Disconnected
NUM
Capture

Connect To

AVEA

Enter details for the phone number that you want to dial:

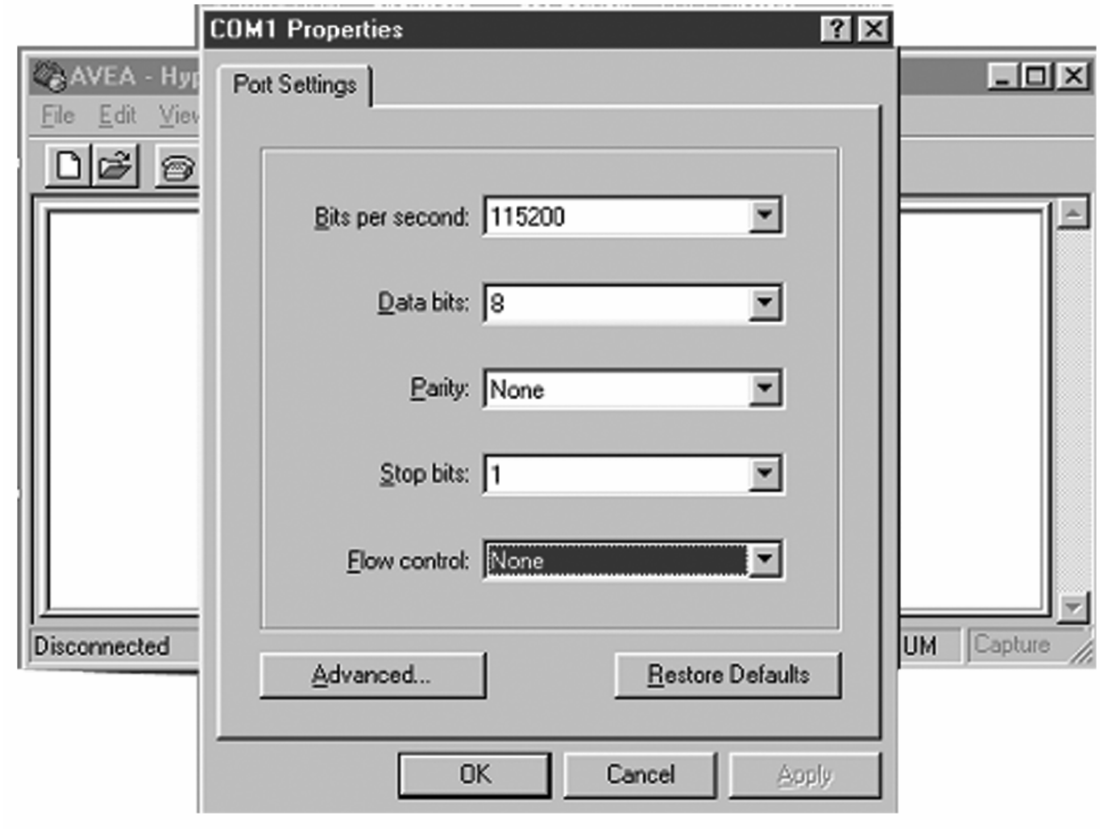
Country code: United States of America (1)

Area code: 909

Phone number:

Connect using: Direct to Com1

In the Connect Using bar, type Direct to Com1 (or Com2 if that is your computer connection).
The Port Settings window opens



COM1 Properties

Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

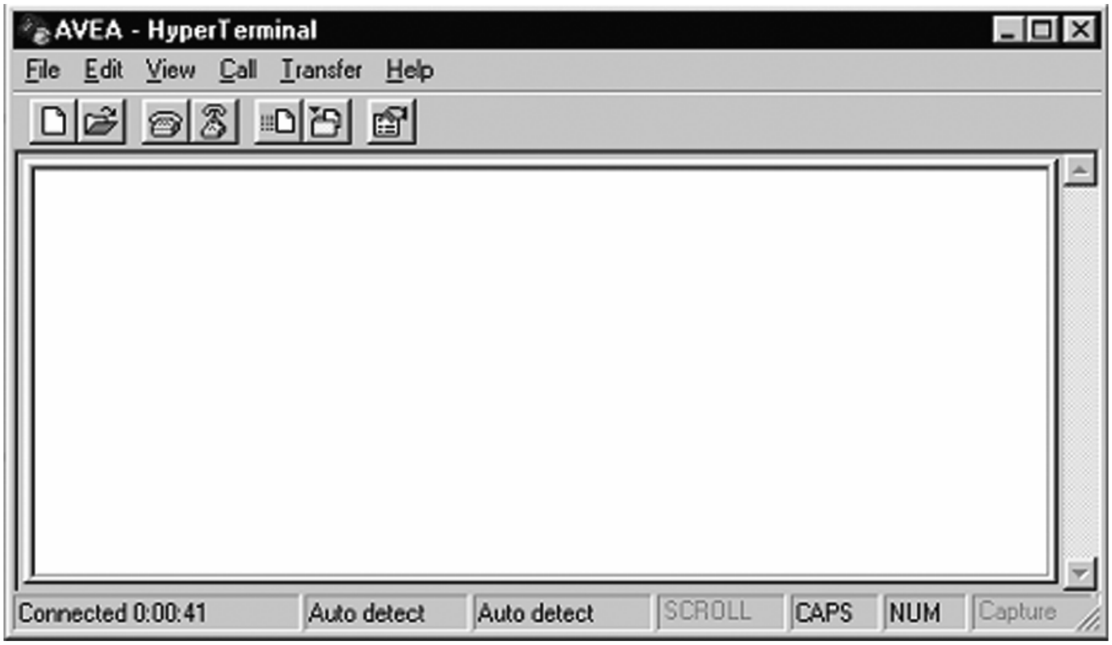
AVEA - Hyp
File Edit View
Port Settings
Advanced...
Restore Defaults
OK
Cancel
Apply
Disconnected
UM
Capture

Enter the following values:

- Bits per second = 115200
- Data bits = 8
- Parity = None
- Stop bits = 1
- Flow control = None

Click OK

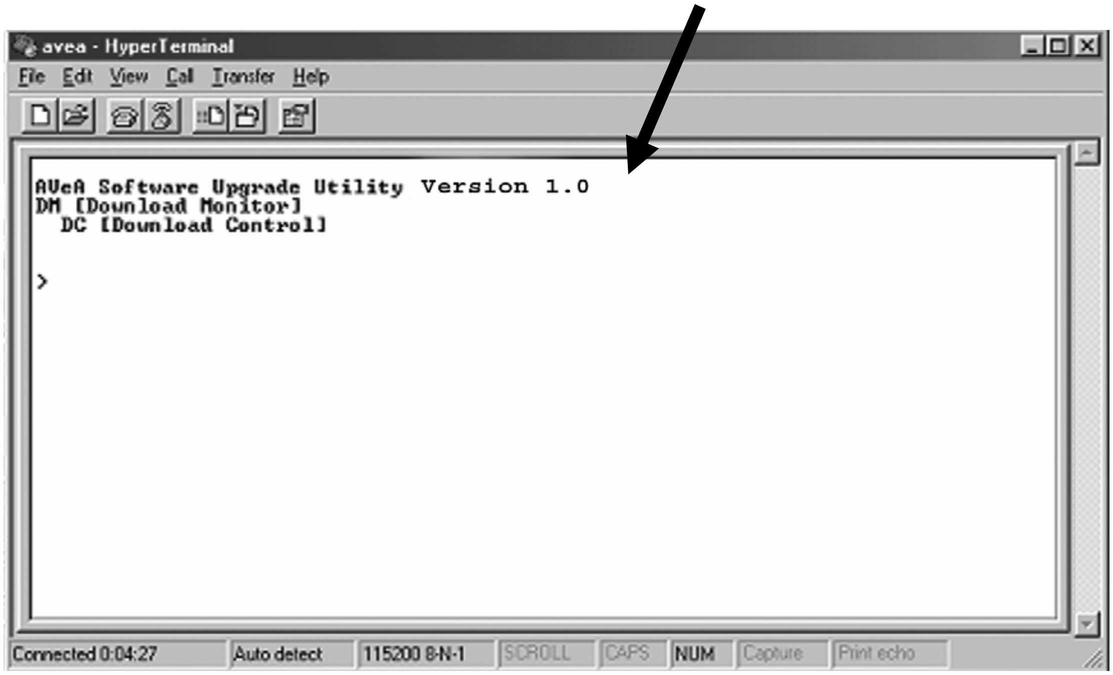
The AVEA HyperTerminal window opens.


AVEA - HyperTerminal
File Edit View Call Transfer Help
Connected 0:00:41
Auto detect
Auto detect
SCROLL
CAPS
NUM
Capture

4. Power up the AVEA

Hold down Expiratory Hold key on the front membrane panel of the AVEA during the ventilator power-up sequence until the front panel LEDs light up.

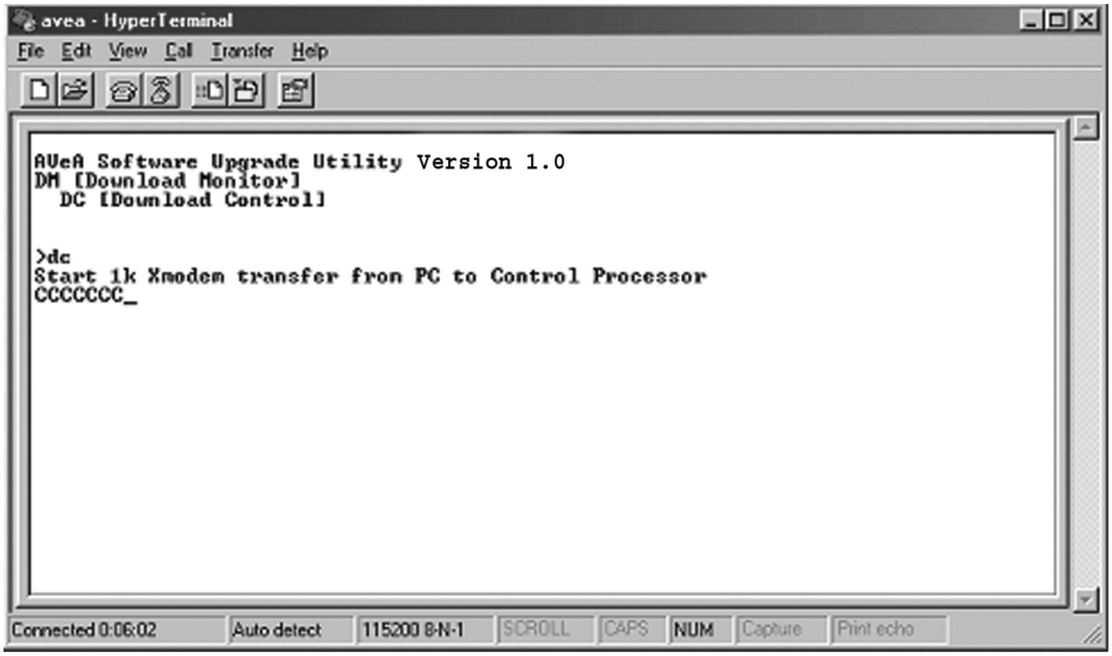
When the LEDs turn off, the Upgrade Utility banner should appear in the terminal software (HyperTerminal) window.


avea - HyperTerminal
File Edit View Call Transfer Help
Connected 0:04:27
Auto detect
115200 8-N-1
SCROLL
CAPS
NUM
Capture
Print echo

```
AVeA Software Upgrade Utility  Version 1.0
DM [Download Monitor]
  DC [Download Control]


>
```

The connection is established and ready to transfer the new software.



avea - HyperTerminal
File Edit View Call Transfer Help

```
AVeA Software Upgrade Utility Version 1.0
DM [Download Monitor]
  DC [Download Control]


>dc
Start 1k Xmodem transfer from PC to Control Processor
CCCCCCC_
```

Connected 0:06:02 | Auto detect | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

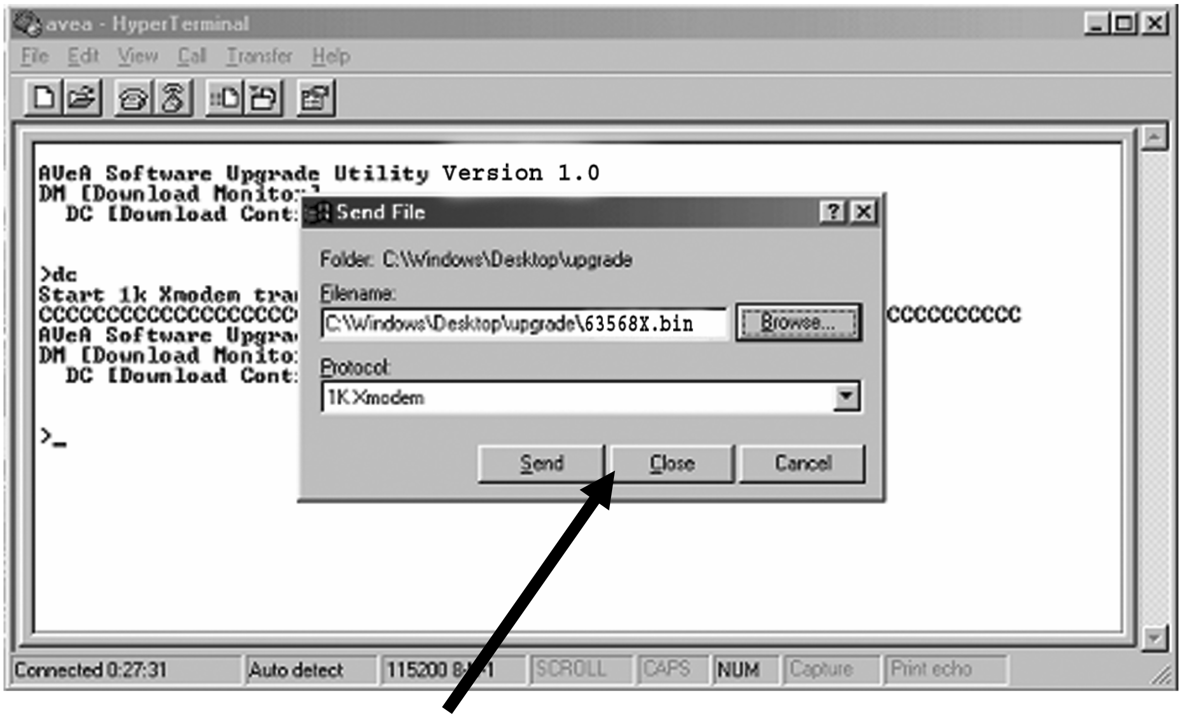
Type DC at the command prompt > and press ENTER to start the download for the Ventilator Control software.

From the **Transfer** menu, select **Send File**

Ensure the protocol is set to “1K XMODEM”.

Click **Browse** and navigate to the desktop where you saved the binary files.

Select the Control file to transfer (e.g. 63568X, bin) and click **Send.**



avea - HyperTerminal
File Edit View Call Transfer Help
Send File
Browse...
Send
Close
Cancel

```
AVeA Software Upgrade Utility Version 1.0
DM [Download Monito
  DC [Download Cont


>dc
Start 1k Xmodem tra
CCCCCCCCCCCCCCCCCC                                   CCCCCCCCCC
AVeA Software Upgra
DM [Download Monito
  DC [Download Cont


>_
```

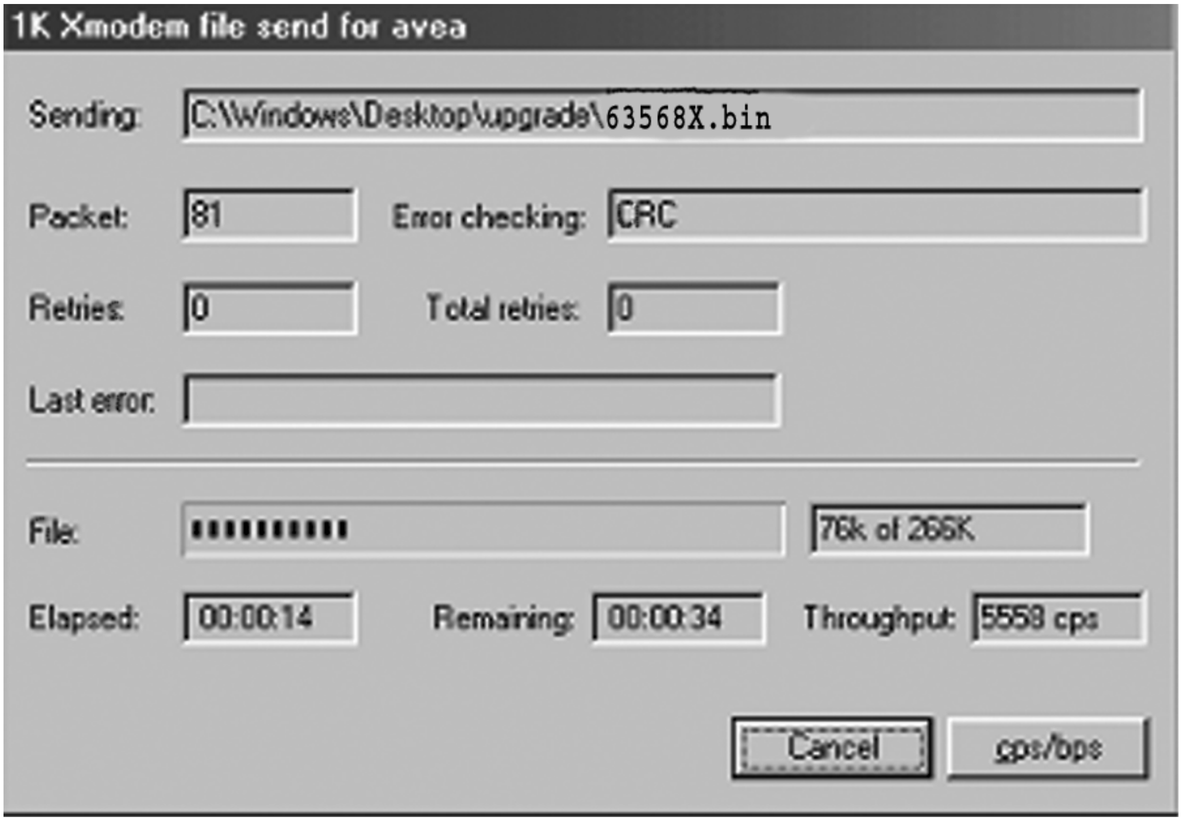
Folder: C:\Windows\Desktop\upgrade

Filename: C:\Windows\Desktop\upgrade\63568X.bin

Protocol: 1K Xmodem

Connected 0:27:31 | Auto detect | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

The file will begin transferring and should be monitored on the display


1K Xmodem file send for avea
Cancel
cps/bps

Sending: C:\Windows\Desktop\upgrade\63568X.bin

Packet: 81

Error checking: CRC

Retries: 0

Total retries: 0

Last error:

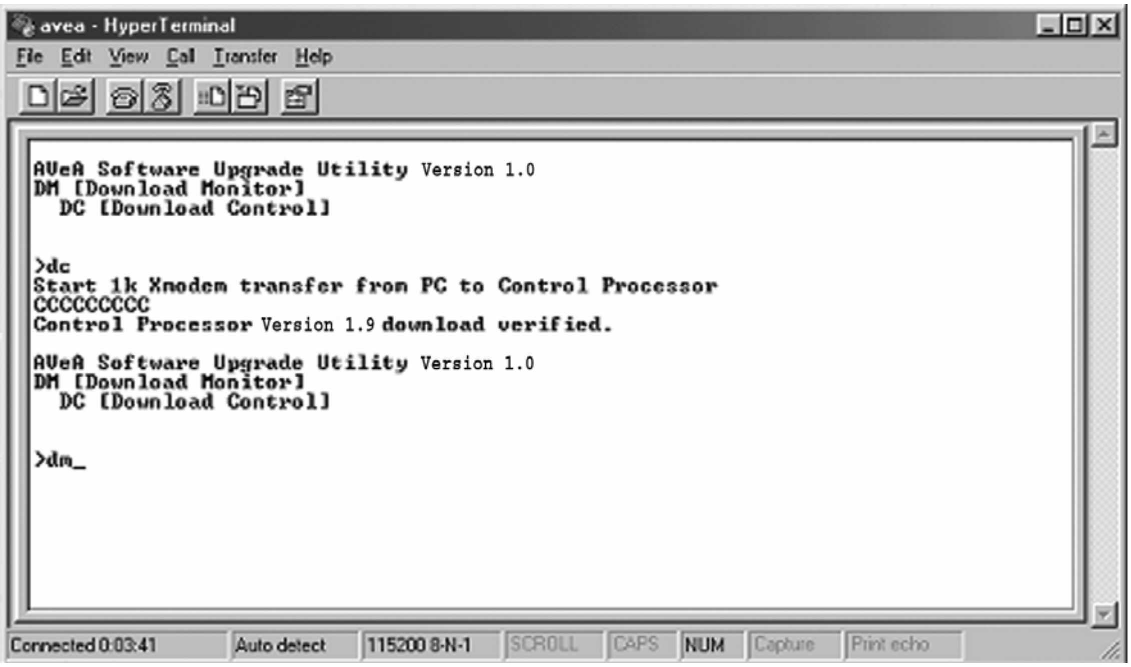
File: 76k of 266K

Elapsed: 00:00:14

Remaining: 00:00:34

Throughput: 5558 cps

A confirmation will be displayed in the terminal window when the file has successfully transferred.


avea - HyperTerminal
File
Edit
View
Call
Transfer
Help
Connected 0:03:41
Auto detect
115200 8-N-1
SCROLL
CAPS
NUM
Capture
Print echo

```
AVeA Software Upgrade Utility Version 1.0
DM [Download Monitor]
  DC [Download Control]


>dc
Start 1k Xmodem transfer from PC to Control Processor
CCCCCCCCC
Control Processor Version 1.9 download verified.

AVeA Software Upgrade Utility Version 1.0
DM [Download Monitor]
  DC [Download Control]


>dm_
```

Repeat the process by typing DM at the command prompt and pressing RETURN to start the download for the Ventilator Monitoring software.

Select the SendFile command from the Transfer menu

Ensure the protocol is set to “1K XMODEM”.

Select the Monitor file (e.g. 635X.bin) as the file to send for the monitor program.

When the transfer is complete, power-down the ventilator and disconnect from PC.

The upgrade is complete.

Checks

When you turn the Ventilator Back “ON“ the Power On Self Tests (POST) will be performed automatically as detailed in the Operator’s Manual.

When the MAIN screen displays, you will see the new version displayed on the bottom of the Touch Screen.

Confirm active waveforms are displayed on the MAIN screen.

Complete the checklist for this procedure and return or FAX to:

VIASYS Respiratory Care Division

Technical Support

22745 Savi Ranch Parkway

Yorba Linda, CA 92887

USA

FAX: 1-714-283-8471

IMPORTANT:

The User Verification Tests (i.e. The EST and Manual Alarms Checks) detailed in the operator’s manual, should be performed prior to patient connection.

Software Install Verification AVEA Ventilators

Date:_________________ Model: Standard ☐ Plus ☐ Comprehensive ☐

UIM Serial # _______________ Ventilator Serial # ________________

Prior Software Version (from MAIN screen) ________________

New Software version ________________

Installation Verification

Monitor processor _________* verified ☐

Control processor _________ * verified ☐

* *Insert version indicated by device*

Confirmation checks

Ventilator power up and POST ☐

New software version displayed ☐

Waveforms on MAIN screen ☐

Unit is VENT INOP ☐

Signature: _____________________________ Date:_______________

Title: _________________________________

Verification and Calibration

1. Once the software has been loaded turn unit OFF.
2. Remove download cable, turn unit ON and verify the following.
    - A. The standard AVEA alarm sound during normal power up.
    - B. That the version as labeled on the CD briefly flashes on the bottom of the UIM.
    - C. The RED vent inop indication appears in the upper right hand of the UIM.
    - D. Warning Default Screen appears, Press Continue.
    - E. Patient select screen appears, Press Patient Accept icon.
3. Turn the unit OFF.
4. Power up the unit while holding the set up button.
5. Verify the following.
    - A. The current version of software briefly flashes on the bottom of the UIM.
    - B. The SERVICE FUNCTION screen appears.
    - C. The vent inop alarm appears in YELLOW.
    - D. Pressing the ALARM RESET clears the YELLOW vent inop and is replaced by the solid GREEN bar.
6. Press the OVP icon and verify the following:
    - A. OVP screen appears
    - B. All alarms are silenced
7. Perform screen calibration (see page7-1_)

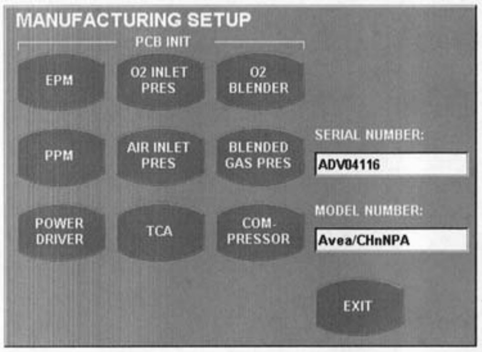
Test and Access of the Security System

Note:

The passwords for the calibration, mfg. setup and model number are all based on the serial number of the unit as it is displayed in the service screen. If the serial number of the device is incorrectly stored in memory then the password to change the serial must be acquired from a Viasys Technical Support Specialist.

1. Access the SERVICE FUNCTION screen as described above and verify the following
    - A. Press the MFG SETUP icon
    - B. Verify that the serial number as displayed matches the serial number on the back of the unit.
    - C. If the correct serial number is not displayed, note the serial number displayed. Press the “Main” button on the UIM and note Hours Run. This information will be needed to change the serial number of the unit.

2. Contact VIASYS Technical Support for Security Codes
    - A. Dial (800) 328-4139. Follow prompts.
    - B. Give the following details to the Technical Support Person
        1. The facility Name.
        2. The S/N of the Unit and UIM.
        3. The current Configuration of the unit (HELIOX, COMPRESSOR, Pes receptacle, etc).
3. Enter the MFG. SETUP Screen and enter the PASSWORD. Verify and perform the following:
    - A. That the MANUFACTURING SETUP screen appears.



SERIAL NUMBER: ADV04116

MODEL NUMBER: Avea/CHnNPA

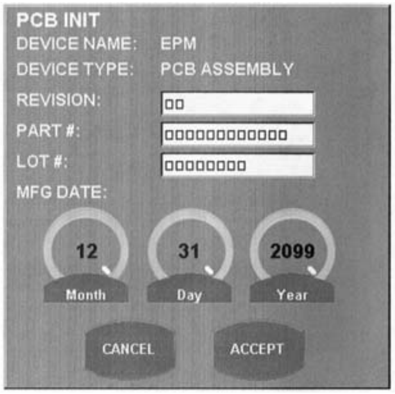
- B. That the MODEL NUMBER reads INVALID.
- C. Press the MODEL NUMBER window.
- D. Enter Model Number PASSWORD and ensure the MODEL NUMBER window now indicates the configuration of the unit.
- E. SERIAL NUMBER matches serial tag on pneumatic module. **If the serial number does not match contact a Viasys Technical Support Specialist.**
- F. Select each PCB icons and reenter all previously recorded information; REVISION, PART#, LOT # and MFG DATE if available.

Note:

If the PCB INIT information is missing it should be re-entered at this time. Refer to the PCB INIT that you previously recorded prior to installing the Software.

Note:

If the unit is equipped with the EPM PCBA then it must be initializes at this time. To initialize press the EPM icon, press the rectangular white REVISION box and enter the letter A. Press the Month, Day and Year icons entering the current date. (Today's date) Press ACCEPT in the PCB INIT window..



PCB INIT

DEVICE NAME: EPM

DEVICE TYPE: PCB ASSEMBLY

REVISION: 00

PART #: 000000000000

LOT #: 00000000

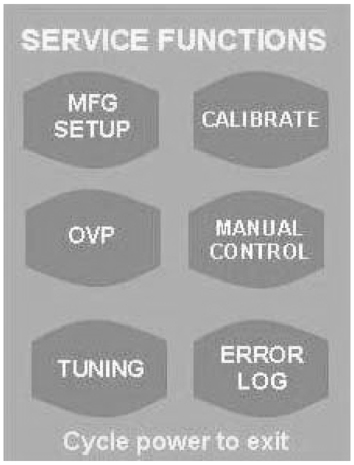
MFG DATE: 12 31 2099

Month
Day
Year
CANCEL
ACCEPT

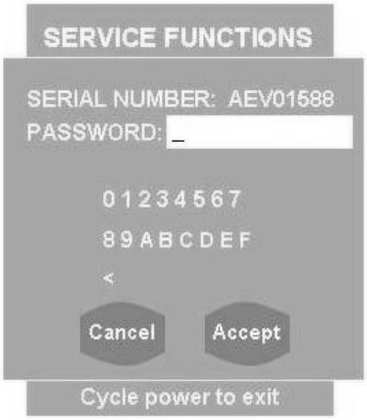
Note:

All Verification and Calibration procedures must be completed using wall gas supplies. Do not utilize the internal compressor for this procedure.

1. At the MFG SETUP screen press EXIT
2. On the Service Functions screen, press CALIBRATE, enter the PASSWORD, and press ACCEPT.



SERVICE FUNCTIONS
MFG SETUP
CALIBRATE
OVP
MANUAL CONTROL
TUNING
ERROR LOG
Cycle power to exit



SERVICE FUNCTIONS

SERIAL NUMBER: AEV01588

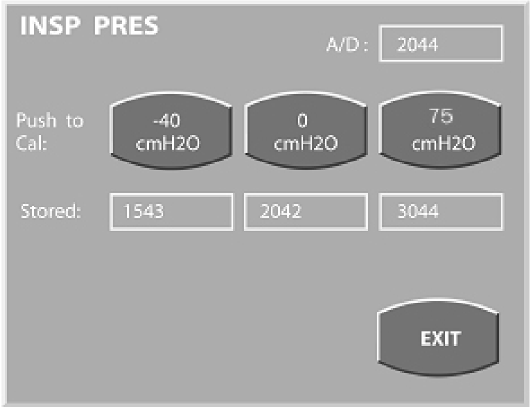
PASSWORD: _

0 1 2 3 4 5 6 7
8 9 A B C D E F
<
Cancel
Accept
Cycle power to exit

Note:

During this procedure you will need to either verify or calibrate the PRESSURE TRANSDUCERS. Ensure all proper test fixture and test devices are available. Each step must be followed to ensure proper verification and/or calibration.

3. Press the INSP PRES icon and verify that the stored and A/D information is in the thousands range (EXAMPLE) A/D 2000, Stored: 1500, 2000, 2900 and the message INVALID CALIBRATION does not appear.



INSP PRES

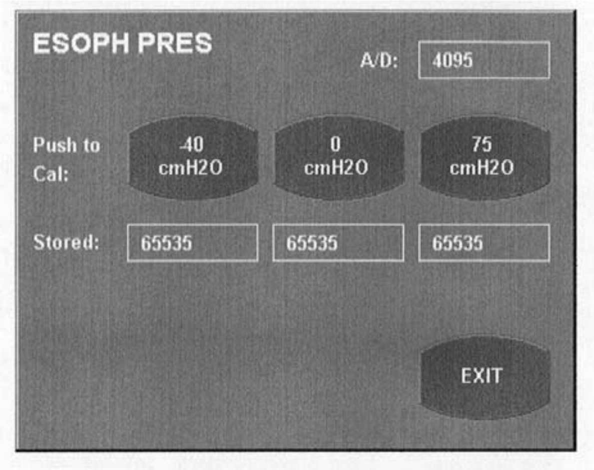
A/D : 2044

Stored: 1543 2042 3044

Note:

If INVALID CALIBRATION does appear then calibration of the transducer is required.

4. Press EXIT and then Press ESOPH PRES.
5. Verify that the unit is equipped with the Pes receptacle on the front of the unit. If it does not, ignore the INVALID CALIBRATION message; otherwise calibration is required.



ESOPH PRES

A/D: 4095

Stored: 65535 65535 65535

INVALID CALIBRATION

6. Press EXIT and perform this procedure for the remaining transducers.

Note:

If calibration is required it should be completed at this point. Refer to the Transducer calibration steps.

AVea

Chapter 7 Calibration

Note

Service screens should be accessed without engineering direction.

Prior to calibration, warm the unit for 30 minutes.

It is important to note that the Screen Calibration MUST be performed any time the instrument's device configuration is changed, new software is installed or if the flash memory is erased.

SHOULD THE ERASE FLASH BUTTON BE PRESSED, THE INSTRUMENT MUST BE TURNED OFF AND RESTARTED IN THE SERVICE FUNCTION MODE BEFORE RECALIBRATING THE SCREEN. Failure to follow these steps will prevent the instrument from storing the screen calibration.

The screen calibration will be lost under the following circumstances:

- *Erasure of the flash memory*
- *Installation of new software*
- *Device configuration change*

Screen Calibration Procedure

WARNING

Service functions should always be done off patient.

Equipment Needed

PDA Stylus or similar dull pointed instrument.

Procedure

Upload ventilator with software Version 3.0
or greater.

Plug the AVEA under test into a suitable AC power source and depress the setup key while powering up the unit.

Select OVP in the Service Functions screen (fig1).

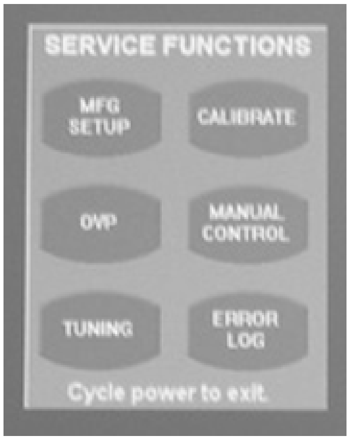

SERVICE FUNCTIONS
MFG SETUP
CALIBRATE
OVP
MANUAL CONTROL
TUNING
ERROR LOG
Cycle power to exit.

Figure 7-1 Service Functions Screen

Select Touch Screen Calibration button and follow the instructions on the screen. You will be prompted to touch points on the upper left, lower right, and middle of the touch screen with the stylus (see figures 3A-C). using a stylus touch on or slightly next to each of these points until prompted to go to the next. DO NOT USE YOUR FINGER FOR THIS PROCEDURE. The screen will automatically go back to OVP when complete.

To insure greatest touch screen accuracy, always perform the calibration procedure twice.

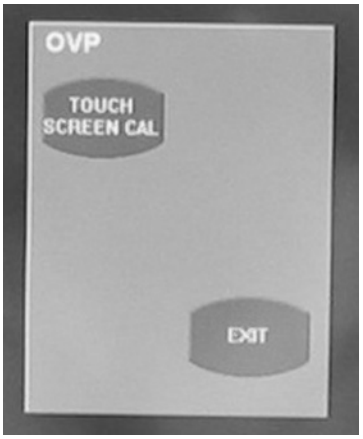

OVP
TOUCH SCREEN CAL
EXIT

Figure 7-2 OVP Screen

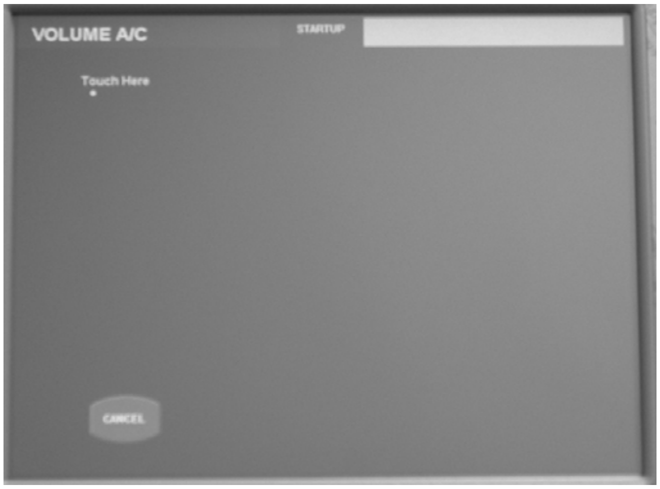

VOLUME A/C
STARTUP
Touch Here
CANCEL

Figure 7-3 Upper Left Touch Point

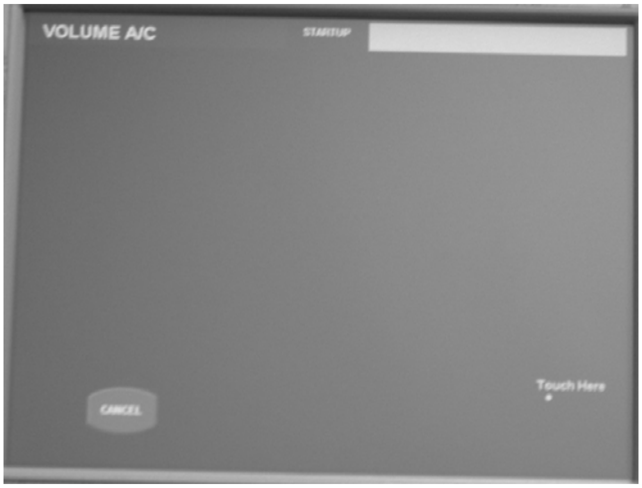

VOLUME A/C
STARTUP
Touch Here
CANCEL

Figure 7-4 Lower Right Touch Point

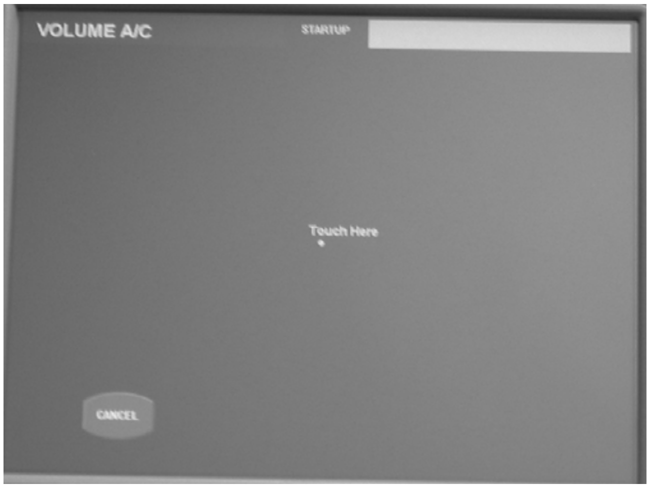

VOLUME A/C
STARTUP
Touch Here
CANCEL

Figure 7-5 Center Touch Point

Power on unit and perform the Manual Alarms Testing section of the AVEA OVP (L2274) to insure accuracy. TO VERIFY SCREEN CALIBRATION, REPEAT THE CALIBRATION PROCEDURE.

Transducer Calibration

AVEA calibration tool kit P/N 03440 contains the equipment required for calibration, maintenance and software downloads.

The millivolt output of pressure transducers are amplified and conditioned prior to being fed to the Analog to Digital Converter (ADC). On the AVEA ventilator, ADC counts are displayed when the ventilator is in the pressure calibration mode. The specific value of the ADC counts are not of significance since they are specific to each pressure transducer and will vary with each manufacturer and production lot. Of more significance is that the ventilator and reference/test instruments have been allowed to come to operational temperature (approximately ½ hour) prior to calibration. This will yield the most accurate calibration.

All Pressure Transducers within the AVEA ventilator have been designed with conditioning circuitry that has the proper offset and gains to allow temperature & time drift of characteristics within the specified operating life of the ventilator. In addition, using software to calculate pressure transducers coefficients at the required calibration intervals, compensates for the drift effects over the life of the ventilator.

If the ventilator is operating within the published specifications and no error codes are being generated, the specific A/D counts for particular pressure transducers are not of significance.

Equipment Required

The following list of parts & tools is recommended for calibrating the AVEA.

Part Number	Description	Quantity
3001083	Catheter assy (8F)	1
51000-40094	Adult wye flow sensor (Vari-Flex, disposable)	2
51000-40096	Connector, AUX port	1
52000-01193	Tube ftg, Tee 1/16 x 1/18 x 1/18 dia	3
32040	Tube ftg 1/8 to 1/16 dia reducer	2
32067	Tube ftg, tee 1/16 x 1/16 x 1/8 dia	1
52000-01205	Luer lock, male 1/16 dia	1
33980	Tubing, poly 12mm OD	1.50ft
52000-00133	Ftg, DISS, air, male ¼ NPT	1
32002	Ftg, fem R/A Elbow 12mm OD	1
52000-00132	Ftg, Oxygen, ¼ NPT x 9/16 male	2
51000-09558	Calibration syringe	1

Calibration setup

The generic setup shown in figure 7.7 is recommended for calibrating the low-pressure ports of the AVEA.

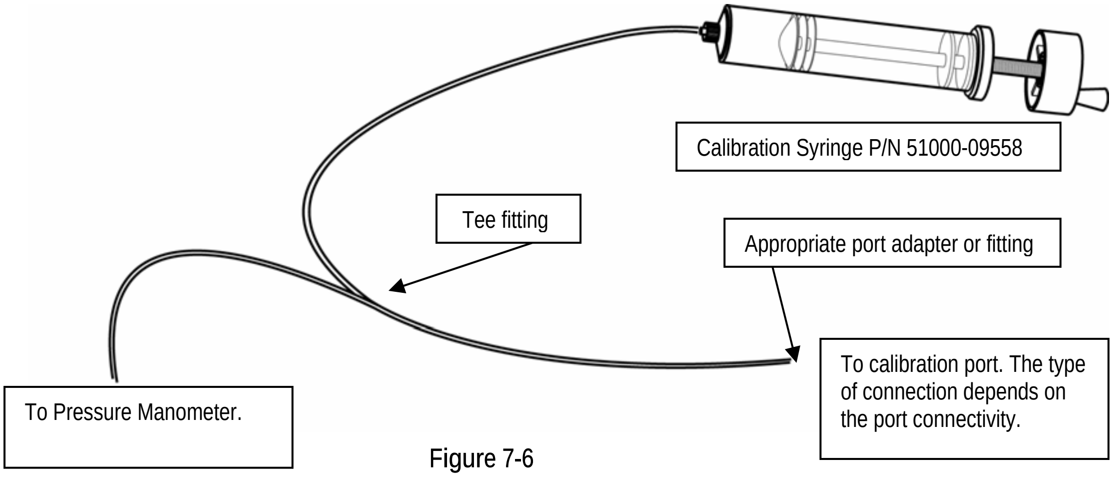

Calibration Syringe P/N 51000-09558
Tee fitting
Appropriate port adapter or fitting
To calibration port. The type of connection depends on the port connectivity.
To Pressure Manometer.

Figure 7-6

Figure 7-7 Calibration setup #1 for low-pressure gases

Note

Before using any test equipment [electronic or pneumatic] for calibration procedures, the accuracy of the instruments must be verified by a testing laboratory. The laboratory master test instruments must be traceable to the NIST (National Institute of Standards Technology) or equivalent. When variances exist between the indicated and actual values, the calibration curves [provided for each instrument by the testing laboratory] must be used to establish the actual correct values. This certification procedure should be performed at least once every six months. More frequent certification may be required based on usage.

Accessing the Calibration Screen

To access the calibration:

1. When the Service Functions screen appears (see figure 7.8), press Calibrate.
2. The Calibration menu screen will appear (see figure 7.9).

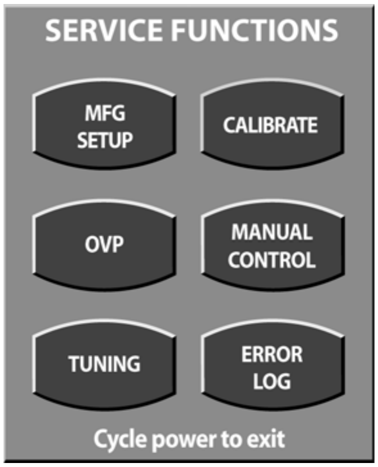

SERVICE FUNCTIONS
MFG SETUP
CALIBRATE
OVP
MANUAL CONTROL
TUNING
ERROR LOG
Cycle power to exit

Figure 7-8 Service Functions Screen

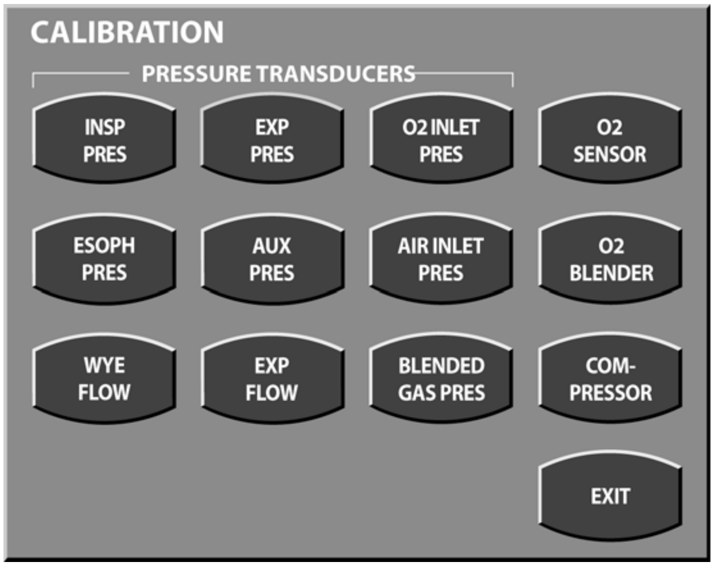
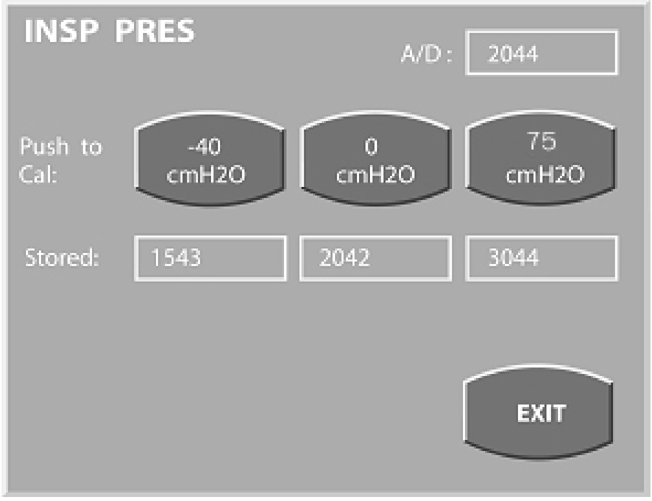

CALIBRATION
PRESSURE TRANSDUCERS
INSP PRES
EXP PRES
O2 INLET PRES
O2 SENSOR
ESOPH PRES
AUX PRES
AIR INLET PRES
O2 BLENDER
WYE FLOW
EXP FLOW
BLENDED GAS PRES
COM-PRESSOR
EXIT

Figure 7-9 Calibration Menu Screen

Inspiratory Pressure Calibration

NOTE: Pictorial depictions of screens are for example ONLY and do not represent actual numbers/counts required during calibration.

1. From the Calibration screen menu, press INSP PRES to access the inspiratory pressure transducer calibration screen. See figure 7.10



INSP PRES

A/D : 2044

Stored: 1543 2042 3044

Figure 7-10 Inspiratory pressure transducer calibration screen

2. Disconnect the Luer fitting and tube from port E4 on the gas delivery engine. See figure 7.11. and tubing diagram in appendix B.

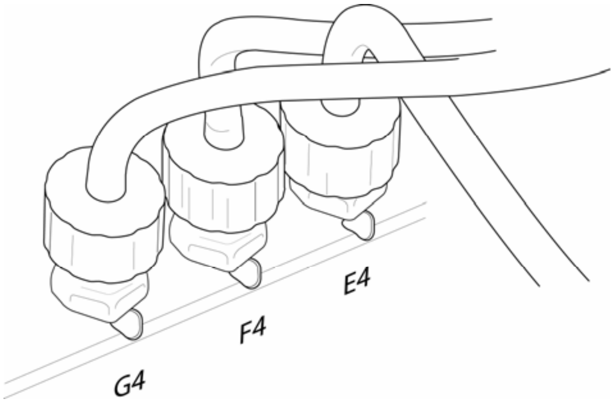


Figure 7-11 Port E4

3. With NOTHING attached to the port, press the Zero (0) calibration button on the touch screen.
4. Attach the calibration assembly shown here to port E4 on the gas delivery engine. To do this attach a length of tube with the appropriate Luer fitting to the Luer receptacle at E4 and connect to the calibration assembly setup using a barbed “T” fitting.

5. Using the calibration syringe P/N 51000-09558; slowly apply negative pressure to the port at E4. (Turn counter clockwise for negative pressure).
6. Refer to the reading on the calibrated Pressure Manometer (model RT200 made by Time Meter, recommended). When the correct reading of – 40 cmsH2O is obtained, press the corresponding calibration button on the touch screen.
7. For positive pressure calibration, turn the syringe handle clockwise until the reading matches the 75 cmH2O number on the touch screen then press the corresponding button.
8. Press EXIT to exit.
9. Disconnect calibration set-up from E4.
10. Reconnect the Luer fitting and tube into port E4 on gas delivery engine.

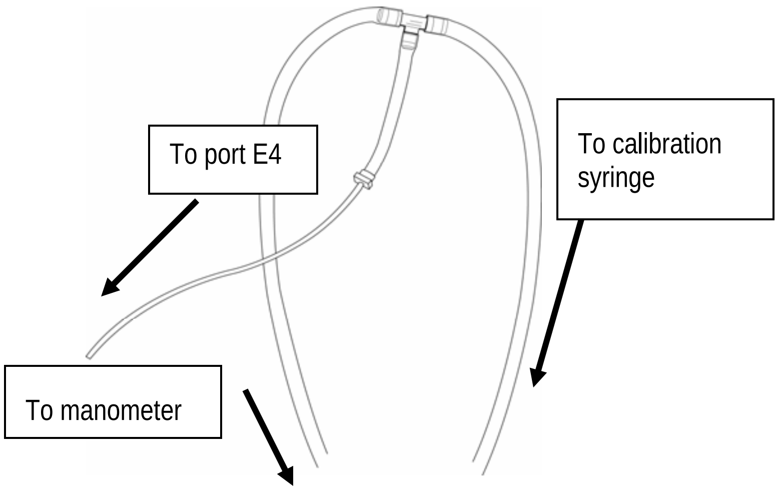
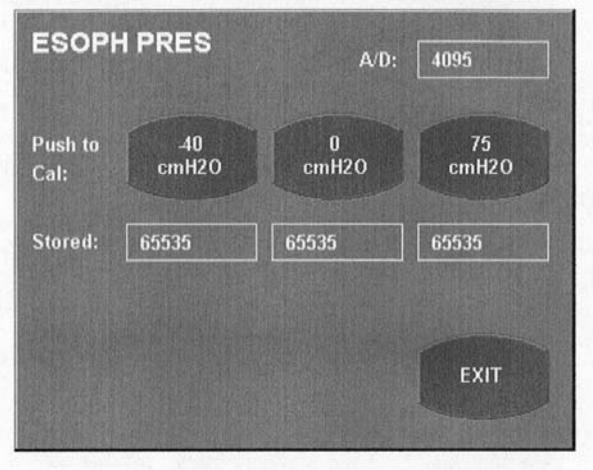


Figure 7-12 Figure 7.6

Esophageal Pressure Calibration

1. From the Calibration screen menu, press ESOPH PRES to access the esoph pressure transducer calibration screen. See figure _____
2. With NOTHING attached to the port, press Zero (0) calibration icon on the touch screen.
3. Attach the calibration assembly to the esoph port on the front of the unit.
4. Using the calibration syringe P/N 51000-09558, slowly apply negative pressure to –40 cm$H_2$0 (turn counter-clockwise for negative pressure).
5. Refer to the reading on the calibrated pressure manometer (RT-200). When the correct reading of –40 cmH_2O is obtained, press the corresponding icon.
6. For positive pressure, turn the syringe handle clock-wise until a reading of 75 cmH_2O is obtained, press the corresponding icon.
7. Press EXIT.



ESOPH PRES

A/D: 4095

Push to Cal:

-40 cmH2O
0 cmH2O
75 cmH2O
EXIT

Stored: 65535 65535 65535

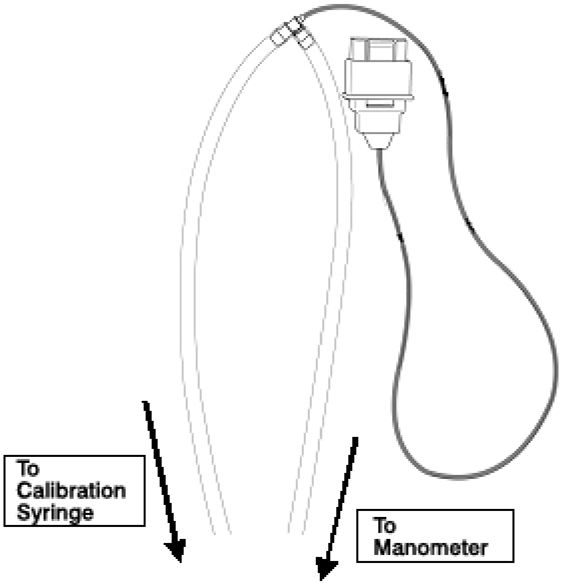

To Calibration Syringe
To Manometer

Figure 7-13

Wye Flow Sensor

1. From the Calibration Screen, press WYE FLOW to access the Wye Flow sensor calibration screen. See figure 7.14.
2. With no sensor attached, press the zero (0 cmH2O) button for a zero calibration value.

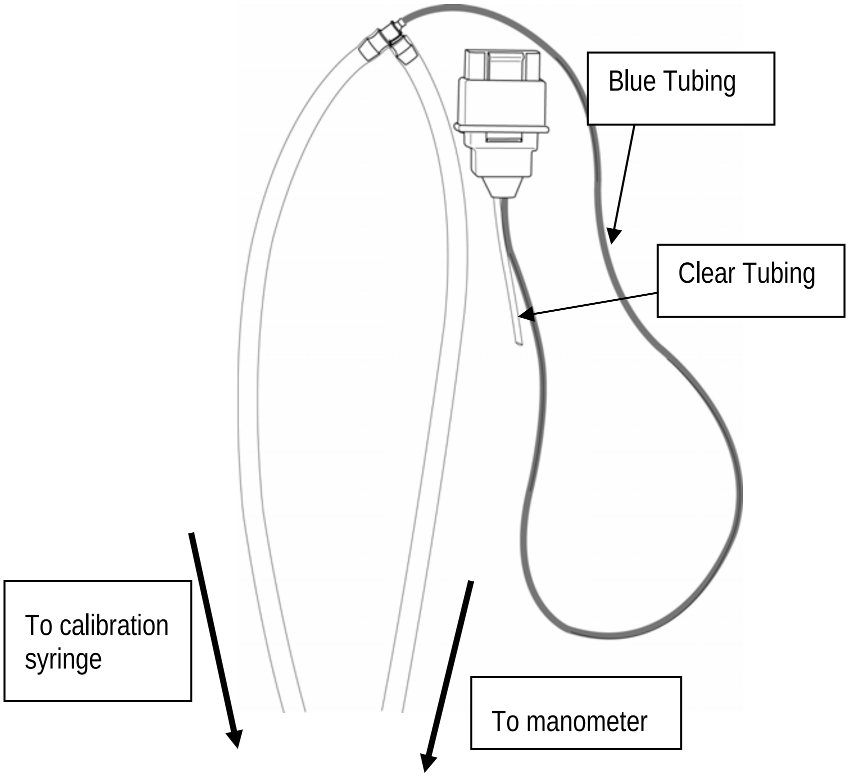


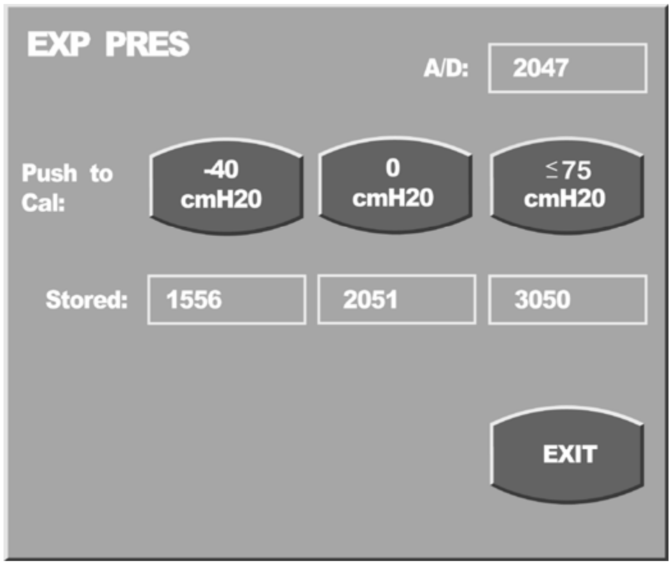
Figure 7-14 Wye flow sensor calibration screen

3. Attach the 51000-40094-sensor connector to the AVEA. Attach the *blue tube only* of the Wye flow sensor to the basic calibration tubing assembly using a barbed fitting. Leave the clear tube unattached as shown here
4. Turn the calibration syringe slowly counter clockwise for a negative pressure of only -4cmsH2O for the negative calibration value and plus 4 cmH2O for the positive value. Press the appropriate touch screen button when each value is reached to capture and store the value.
5. Exit Wye Flow Sensor screen.

> **WARNING**
>
> DO NOT APPLY MORE THAN 10cmH2O TO THIS PORT. Excessive pressure will damage the AVEA. If this occurs immediately contact Technical Support for instructions.

Expiratory Pressure

1. From the Calibration Screen, press EXP PRES to access the calibration screen. See figure 7.15.
2. Remove internal expiratory flow sensor.
3. With no sensor attached, press the zero (0 cmH2O) button for a zero calibration value.

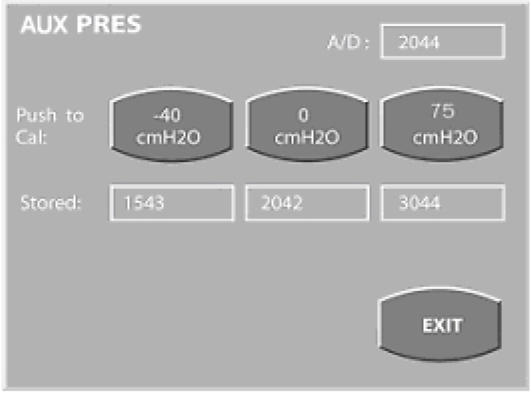


A/D: 2047

Stored: 1556 2051 3050

Figure 7-15 Expiratory Pressure calibration screen

4. From the Calibration screen menu, press AUX PRES to access the aux pressure transducer calibration screen. See figure
5. With NOTHING attached to the port, press Zero (0) calibration icon on the touch screen.
6. Attach the calibration assembly to the aux port on the front of the unit.
7. Using the calibration syringe P/N 51000-09558, slowly apply negative pressure to –40 cmH$_2$0 (turn counter-clockwise for negative pressure).
8. Refer to the reading on the calibrated pressure manometer (RT-200). When the correct reading of –40 cmH$_2$O is obtained, press the corresponding icon.
9. For positive pressure, turn the syringe handle clock-wise until a reading of 75 cmH$_2$O is obtained, press the corresponding icon.
10. Press EXIT.



A/D : 2044

Stored: 1543 2042 3044

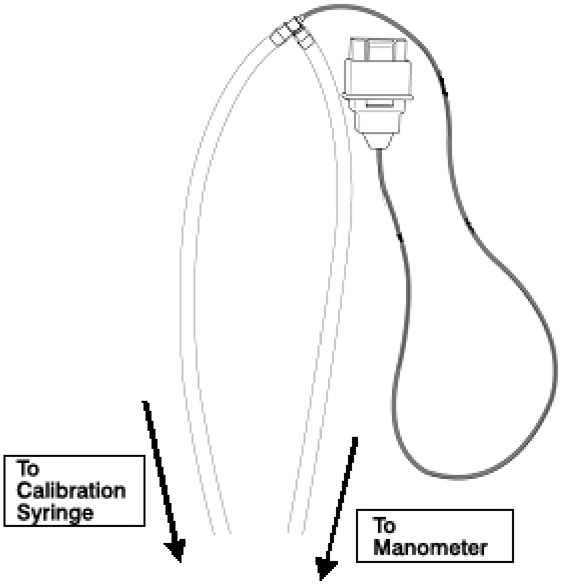

To
Calibration
Syringe
To
Manometer

Figure 7-16

11. Attach *both tubes* (blue & clear) of the Expiratory Sensor P/N 51000-40094 to the basic calibration tubing assembly using a barbed “T” fitting as shown here.

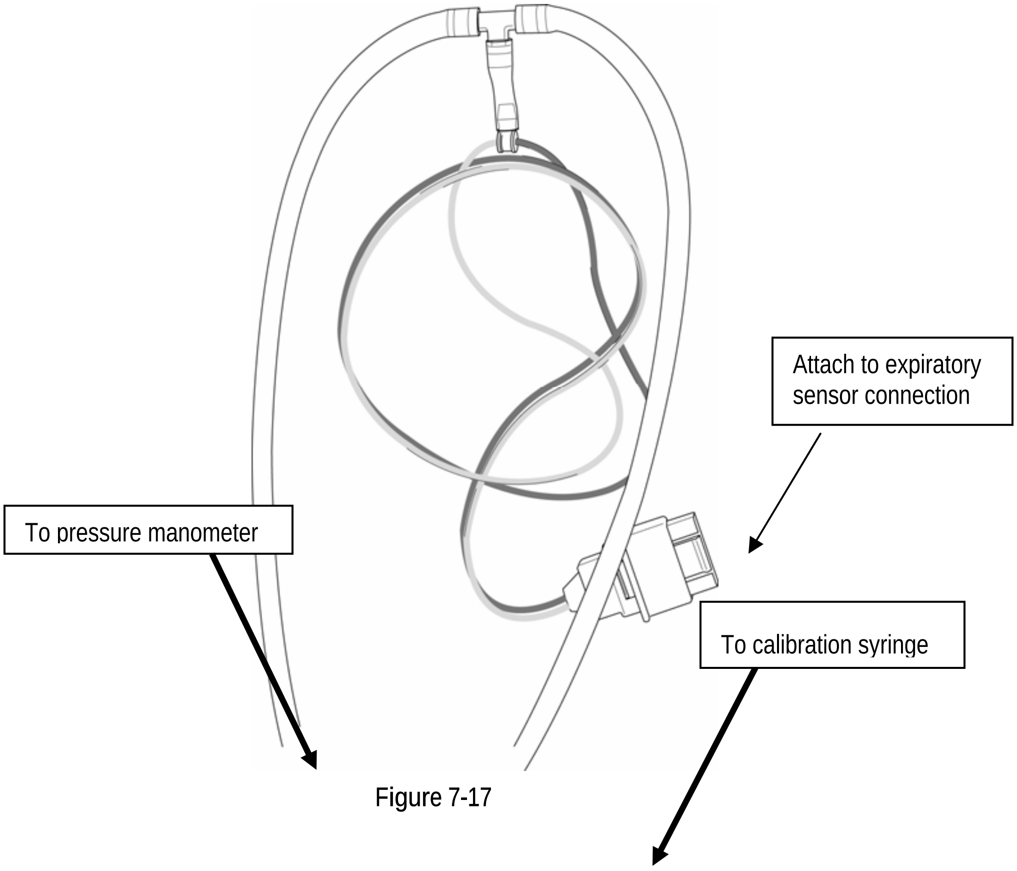

Attach to expiratory
sensor connection
To pressure manometer
To calibration syringe

Figure 7-17

12. Connect the tubing assembly to the internal expiratory sensor port. See figure 7.18 for the sensor connector location.

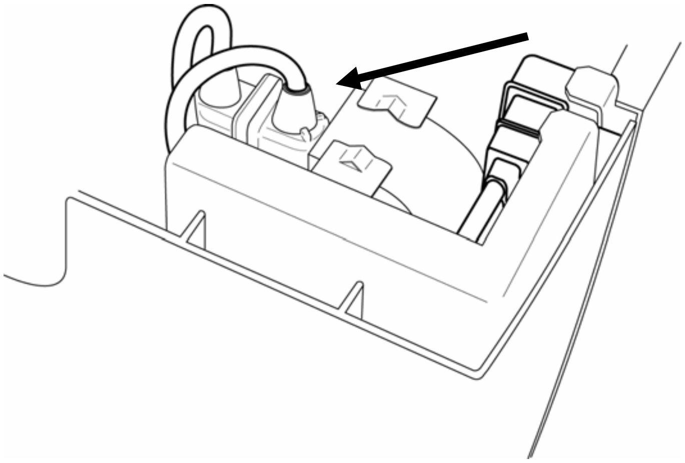


Figure 7-18 Expiratory Sensor connector location

CAUTION

The expiratory sensor connector has a locking sleeve. Be sure to fully retract the sleeve before attempting to attach the connector. Failure to do so could damage the connector.

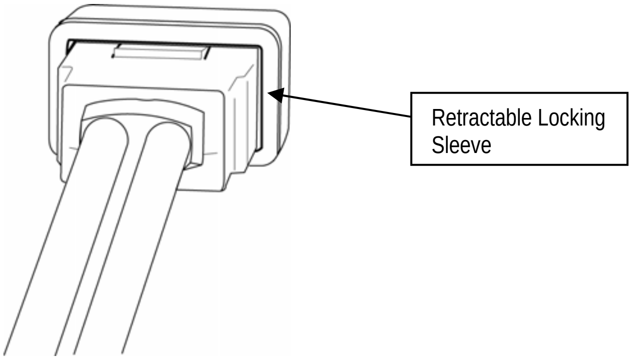


Figure 7-19 Expiratory Sensor Connector

13. Turn the calibration syringe slowly counter clockwise for a negative pressure of -40cmsH2O to establish the negative calibration value and plus 75 cmH2O to establish the positive value. Press the appropriate touch screen button when each value is reached to capture and store the calibration.
14. Press EXIT to exit

Expiratory Flow

1. Press the EXP FLOW touch screen button to access the screen, see figure 7.20.
2. With nothing attached to the ventilator, press the 0 cmH2O touch screen button.

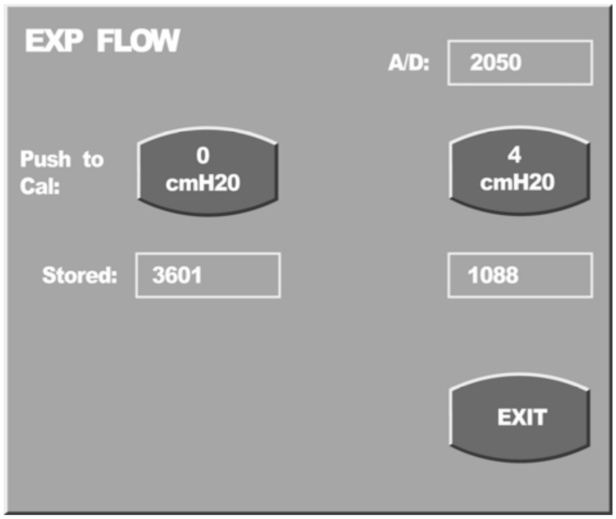


Figure 7-20 Expiratory Flow Calibration Screen

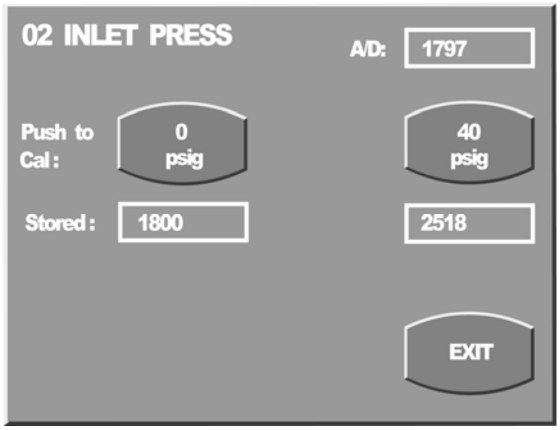
3. Using the same sensor connector and tubing setup as the wye flow calibration, carefully attach the locking sleeved connector to the expiratory flow port as shown in figure 4.11.
4. Turning the calibration syringe clockwise, apply 4-cmH2O pos pressure and press the positive pressure touch screen button.

> WARNING
> Apply NO MORE THAN 10 cmH2O to the port when calibrating this value. Doing so could cause damage to the AVEA. If this occurs immediately contact Technical Support for instructions.

5. Press EXIT to exit.

O2 inlet pressure

1. Press O2 INLET PRES from the Calibration screen to access the O2 Inlet pressure calibration screen.
2. With nothing attached to the instrument, press the 0 psig touch screen button.



02 INLET PRESS

A/D: 1797

Stored : 1800

2518

Figure 7-21 O2 Inlet Pressure calibration screen

3. Use a calibrated 0-150 psi regulator and a wall or cylinder supply of medical oxygen.

3. Using a “Y” adapter (see figure 7.22), attach the “Y” adapter shown here to the regulator. A

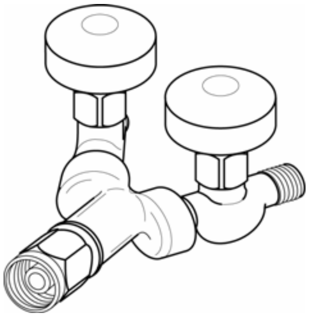


Figure 7-22 “Y” high pressure DISS 1290 adapter

4. Attach one arm of the tubing to the manometer and connect the other (with the correct DISS fitting) to the high pressure O2 inlet on the rear of the instrument shown in figure 7.23.

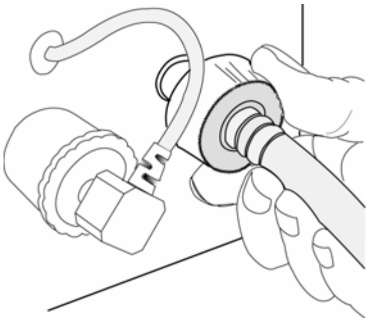


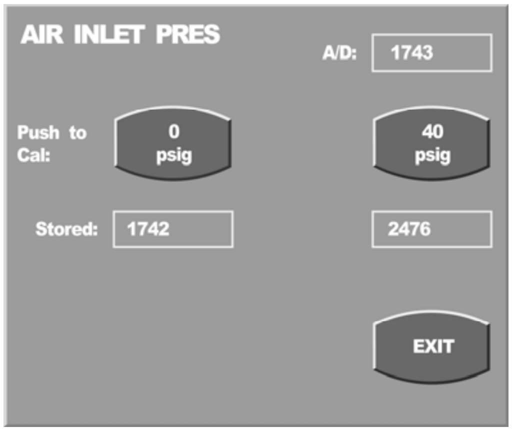
Figure 7-23 O2 hose connection

5. Apply 40psig (2.76 bar) of pressure & press the corresponding touch screen button to calibrate.

Air inlet Pressure

Press the AIR INLET PRES touch screen button from the calibration screen to access the Air Inlet Pressure calibration screen as shown in figure 7.24.

With nothing connected to the air/blended gas inlet port on the rear of the ventilator, press the 0 psig touch screen button.


AIR INLET PRES

A/D: 1743

Push to Cal:

Stored: 1742 | 2476

Figure 7-24 Air Inlet Calibration screen

Connect, a wall or cylinder supply of medical grade air through a calibrated 0-150 psi regulator and "Y" adapter P/N to a manometer and to the high-pressure air/heliox inlet on the rear of the ventilator.

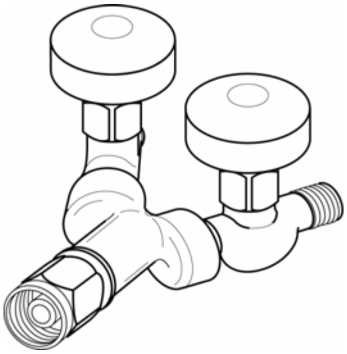
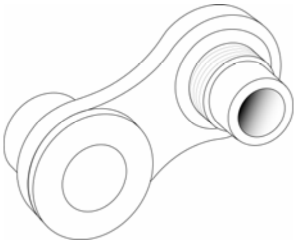


Figure 7-25 "Y" adapter



Attach the air inlet smart connector to the port on the rear of the ventilator.

Figure 7-26 "Smart" Connector

Attach the hose from the calibrated regulator on the medical grade air source to the smart connector port and apply 40psi pressure per the in-line manometer. When the correct reading is obtained, press the 40-psig touch screen button on the Air Inlet calibration screen.

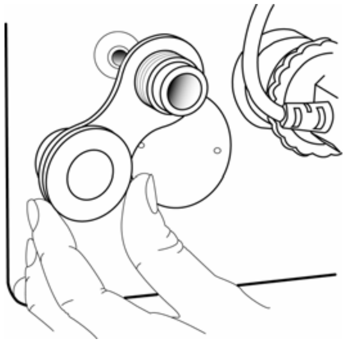
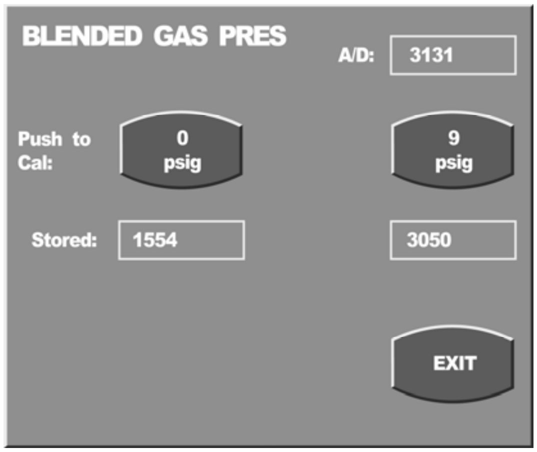


Figure 7-27 Attaching the smart connector

Blended Gas Pressure

1. Press the BLENDED GAS PRES touch screen button from the Calibration screen to access the blended gas pressure calibration screen.
2. Cut cable tie. Remove metal hose stabilizer.
3. Disconnect compressor output hose.



BLENDED GAS PRES

A/D: 3131

Push to Cal:

Stored: 1554 3050

0 psig
9 psig
EXIT

Figure 7-28 Blended Gas Pressure Screen

4. Press 0 psig with nothing connected to the ventilator. Disconnect output tube from the accumulator output to the blender manifold. See figure 7.29.

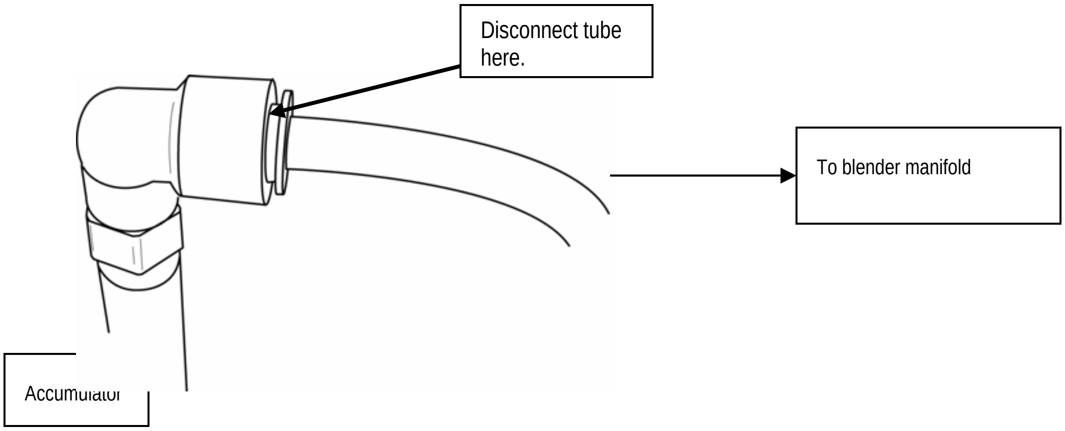

Disconnect tube here.
To blender manifold
Accumulator

Figure 7-29 Port C2 connection

5. Attach special elbow assembly to the accumulator output tubing. Attach also to a calibrated 0-150psi regulator connected to the high-pressure gas source & to a manometer.

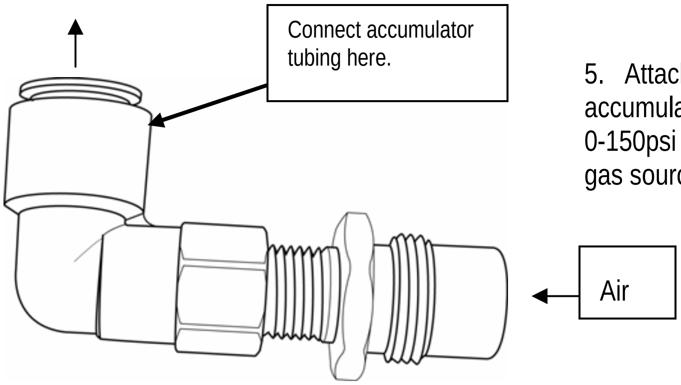

Connect accumulator tubing here.
Air

Figure 7-30 Adapter for accumulator tubing.

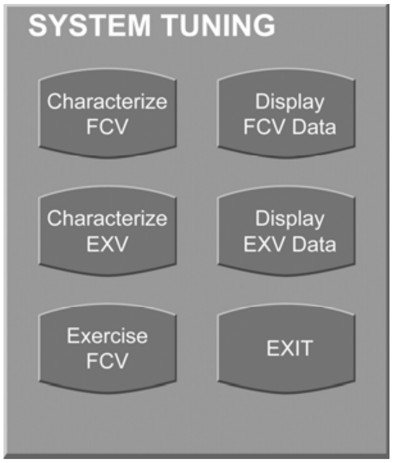
5. Apply 9 psig from the regulator (connected to wall or bottled gas). When the correct reading is obtained on the manometer, press the 9-psig touch screen button.
6. Reconnect and reassemble compressor output hose to blender manifold. Attach metal hose stabilizer. Replace cable tie.
7. Press EXIT to exit.

Flow and Exhalation valve Characterization/Hysteresis Test

NOTE: ALL CHARACTERIZATIONS MUST BE RUN ON 50PSI WALL AIR TO PASS TESTING.

Flow Valve Characterization Test

1. On completion of the transducer verification and calibration, press EXIT and return to the SERVICE FUNCTION screen.
2. Connect a patient circuit and test lung.
3. Press the TUNING icon to access the SYSTEM TUNING screen.
4. After entering the password, select EXERCISE FCV icon.
5. Wait at least 10 minutes and then press the CANCEL icon.
6. Disconnect patient circuit and test lung.
7. Press CHARACTERIZE FCV icon and ensure that the message “FCV Characterization in Process” appears in the lower area of the UIM.
8. This test will run for approximately 30 seconds. After the test, either of the following messages will appear in the message bar in the lower part of the screen: “FCV Characterization Complete” or “FCV Characterization Failed.”

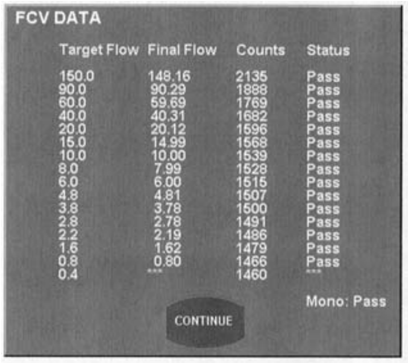


Note:

If the message reads FCV ***Characterization Complete*** *the test has passed successfully. If the message reads failed, recharacterize the FCV will be required. After 3 failed attempts the GDE will require replacement. Contact the Technical Services department and request a new GDE P/N 16222A. If the GDE is replaced all test and verification to this point will need to be readdressed.*

9. Once the FCV Characterization has passed Press Display FCV Data.

10. This data is for reference use only and indicate target flow and final flow determined by the software. Press the continue icon.



FCV DATA

Target Flow	Final Flow	Counts	Status
150.0	148.16	2135	Pass
90.0	90.29	1888	Pass
60.0	59.69	1769	Pass
40.0	40.31	1682	Pass
20.0	20.12	1596	Pass
15.0	14.99	1568	Pass
10.0	10.00	1539	Pass
8.0	7.99	1528	Pass
6.0	6.00	1515	Pass
4.8	4.81	1507	Pass
3.8	3.78	1500	Pass
2.8	2.78	1491	Pass
2.2	2.19	1486	Pass
1.6	1.62	1479	Pass
0.8	0.80	1466	Pass
0.4	***	1460	***

Mono: Pass

Exhalation Valve Characterization Test

Note:

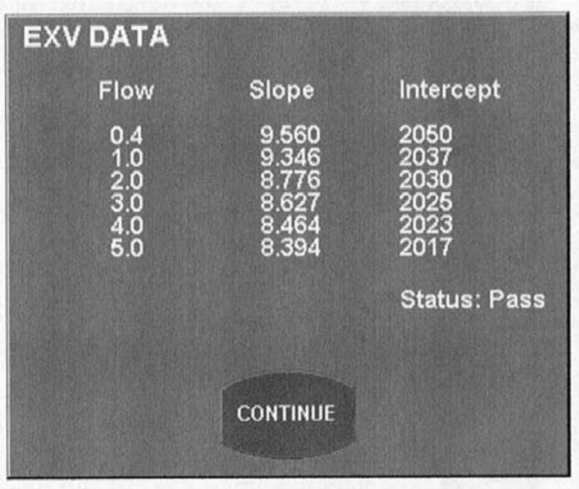
For the following test it is required that the complete filter cartridge with filter and jar are install into the unit. Connect calibration tube P/N 10136 from the Inspiratory outlet to the Exhalation inlet.

1. From the SYSTEM TUNING screen Press the Characterization EXV icon.
2. Ensure that the message EXV Characterization in process appears in the lower area of the UIM.
3. This test will run for 3 -5 minutes and the lower area of the UIM will read EXV Characterization complete or EXV Characterization failed.

Note:

*If the message reads **EXV Characterization Complete** the test has passed successfully. If the message reads failed recharacterize the EXV. After 3 failed attempts the Exhalation Valve will require replacement(P/N 16319). Exhalation valve is included with this kit.*

4. Once the EXV Characterization has passed Press Display EXV Data.
5. This data is for reference use only and indicate flow and Slope determined by the software. Press the continue icon.
6. Press the EXIT icon.



EXV DATA

Flow	Slope	Intercept
0.4	9.560	2050
1.0	9.346	2037
2.0	8.776	2030
3.0	8.627	2025
4.0	8.464	2023
5.0	8.394	2017

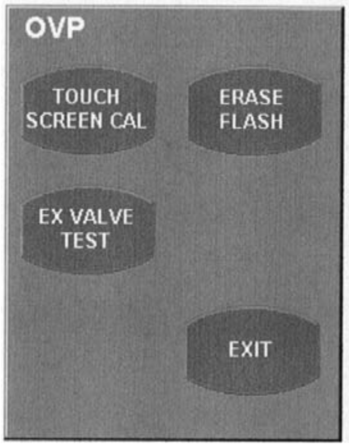
Status: Pass

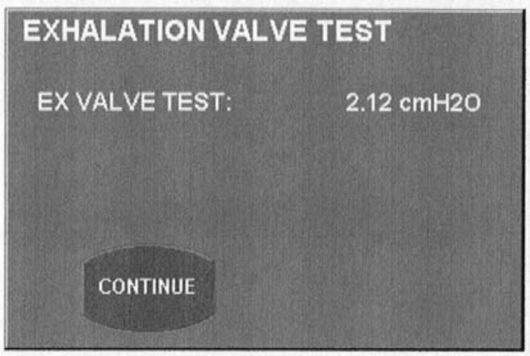
Hysteresis Test

Note:

For the following test the set up is as described in the Exhalation Valve Characterization procedure.

1. Press the OVP icon.
2. Press the EX VALVE TEST icon.
3. Press the CONTINUE icon





EXHALATION VALVE TEST

EX VALVE TEST: 2.12 cmH2O

4. The test may run for up to 5 minutes.
5. The measured hysteresis must be between 1.5 cmH_20 and 4.5 cmH_20.
6. Repeat step 5, 3 times. The maximum variation from any reading shall be 0 .6 cmH_2O

Note:

If the exhalation valve does not pass this test, it will require replacement.

Exhalation Valve Leak Test

1. Turn the unit OFF.
2. Attach breathing circuit and test lung to unit.
3. Turn unit ON and verify the following:
    - A. Audible alarm sounds
    - B. SAFETY VALVE OPEN appears in the upper right of the UIM.
    - C. PATIENT SELECT screen appears.
4. Press PATIENT ACCEPT icon and verify the following
    - A. The unit begins to deliver breaths.
    - B. Alarm at the upper right goes to YELLOW.
    - C. CIRCUIT DISCONNECT appears.
5. Press ALARM RESET button.
6. Set the unit as follows:
    - A. Mode Volume A/C Adult
    - B. Breath Rate 4
    - C. PEEP 30
    - D. Volume at 0.50
    - E. Peak Flow at 20
    - F. Press ADV SETTINGS button
    - G. Press Flow Trigger
    - H. Set Bias Flow to .4
    - I. Press ADV SETTINGS
7. Observe the PAW wave form and allow the unit to cycle several times. Ensure there is no auto cycle
8. Press the Freeze button and scroll cursor across the blue exhalation portion of the waveform. (Refer to illustration below)
9. During the exhalation phase the PEEP level must be stable and +/- 0.1 cm$H_2$0 through out the expiratory phase

AVea

Chapter 8 Preventive Maintenance

PM kit without compressor P/N 16137

PM kit with compressor P/N 16138

Routine Maintenance Procedures

The following parts are typically replaced on an annual basis:

- Air inlet filter
- Oxygen inlet filter
- Compressor inlet filter (if applicable)
- Compressor outlet filter (if applicable)
- Exhalation Diaphragm
- Fan filter

The following service procedures are recommended to be performed annually as well:

1. Remove and replace (items described above)
2. Check Compressor output if applicable
3. Verification testing to confirm the ventilator is functioning within optimum parameters.
4. Screen calibration

Replacing the O2 and Air/Heliox filters.

You can access both these gas filters from the rear panel of the ventilator. See figure 8.1 below.

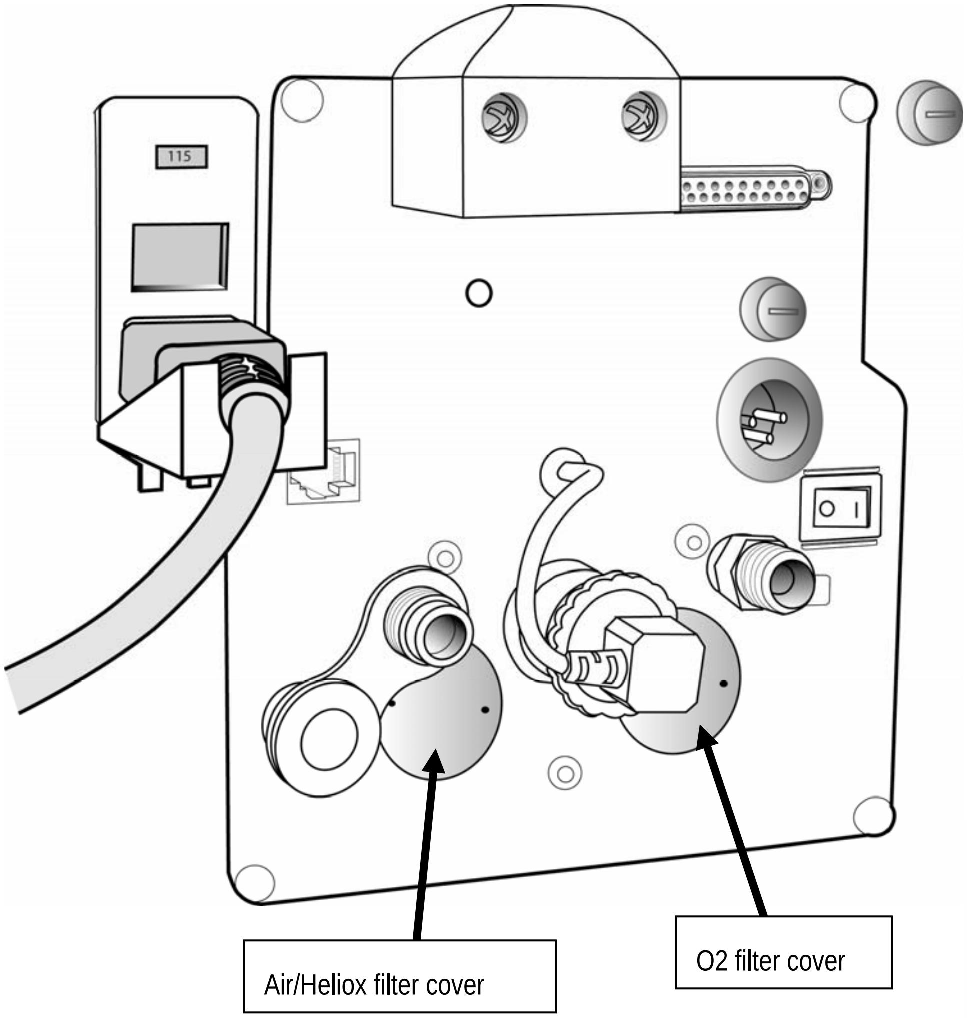

115
Air/Heliox filter cover
O2 filter cover

Figure 8.1 Rear panel

To remove the O2 & Air/Heliox filter covers, you will need tool number 21735 , Inlet Filter Driver available from Viasys Healthcare Technical Support .

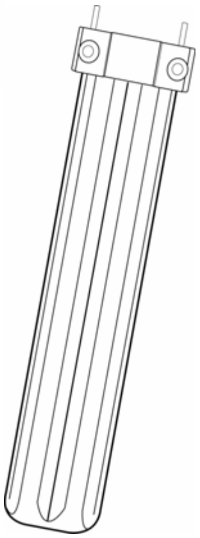


Figure 8.2 Tool 21735

Using tool number 21735, unscrew the filter covers to expose the filters.

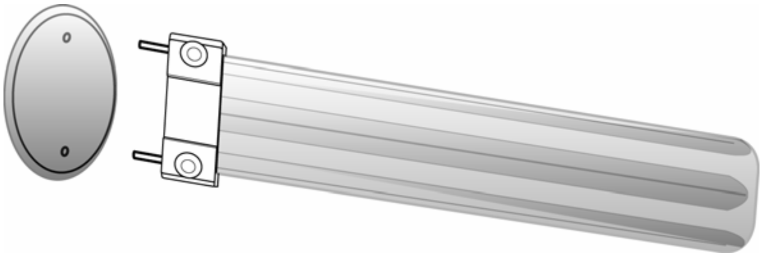
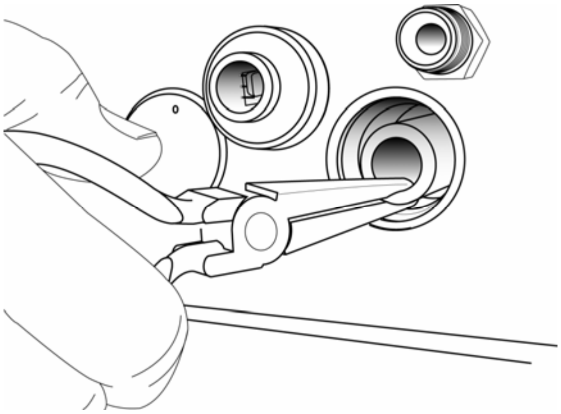


Figure 8.3 Removing the filter covers



Using needle nosed pliers, grasp the filter firmly and pull straight out from the filter port.

Figure 8.4 Removing the filter

Replace the old filters with new ones (Balston P/N 050-05) taking care to seat the filter over the filter retainer inside the port as you insert each one.

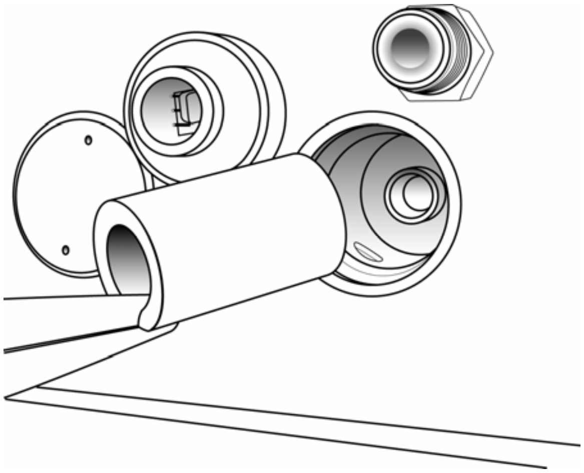
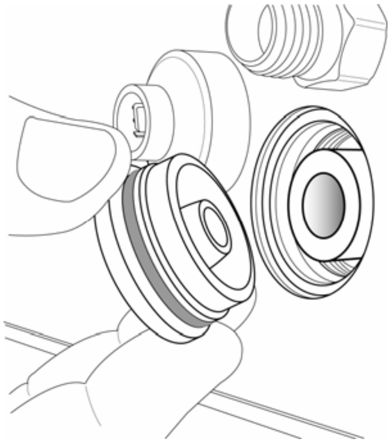


Figure 8.5 Replacing the filter



Align the filter retainer in the center inside the filter as you replace the cover.

Figure 8.6 replacing the filter cover

Replacing the Compressor Inlet & Outlet filters

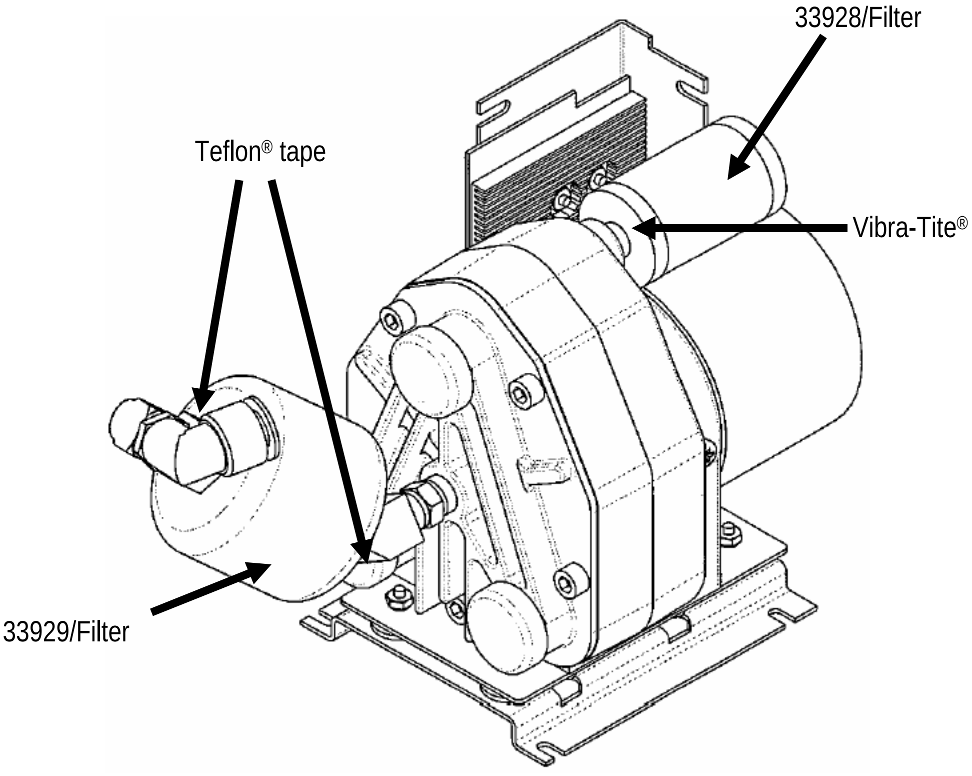


Figure 8.7 Compressor and filters

Disassemble the ventilator as shown in Chapter 4 to access the Compressor filters.

Both the inlet and the outlet filters unscrew as complete assemblies for replacement. Use only the part numbers shown above available from VIASYS Healthcare Critical Care division.

To replace Compressor Inlet Filter:

Apply Vibra-tite to threads of the Compressor Inlet Filter and allow to dry for at least 15 minutes. Install the Compressor Inlet Filter onto the Compressor Scroll Housing.

To replace Compressor Outlet Filter:

Carefully clean tapered pipe threads of brass fittings. Re-apply Teflon tape to fittings, avoiding the first end thread. Attach the Compressor Outlet Filter and secure fittings in the direction shown.

Replacing the Exhalation Diaphragm P/N 16240

To replace the exhalation valve membrane, first remove the following:

- The UIM
- The top cover
- The exhalation filter/water trap assembly
- The exhalation assembly (corner) cover.

Once the top cover and the exhalation cover have been removed, the exhalation assembly should be accessible (see figure 8.8)

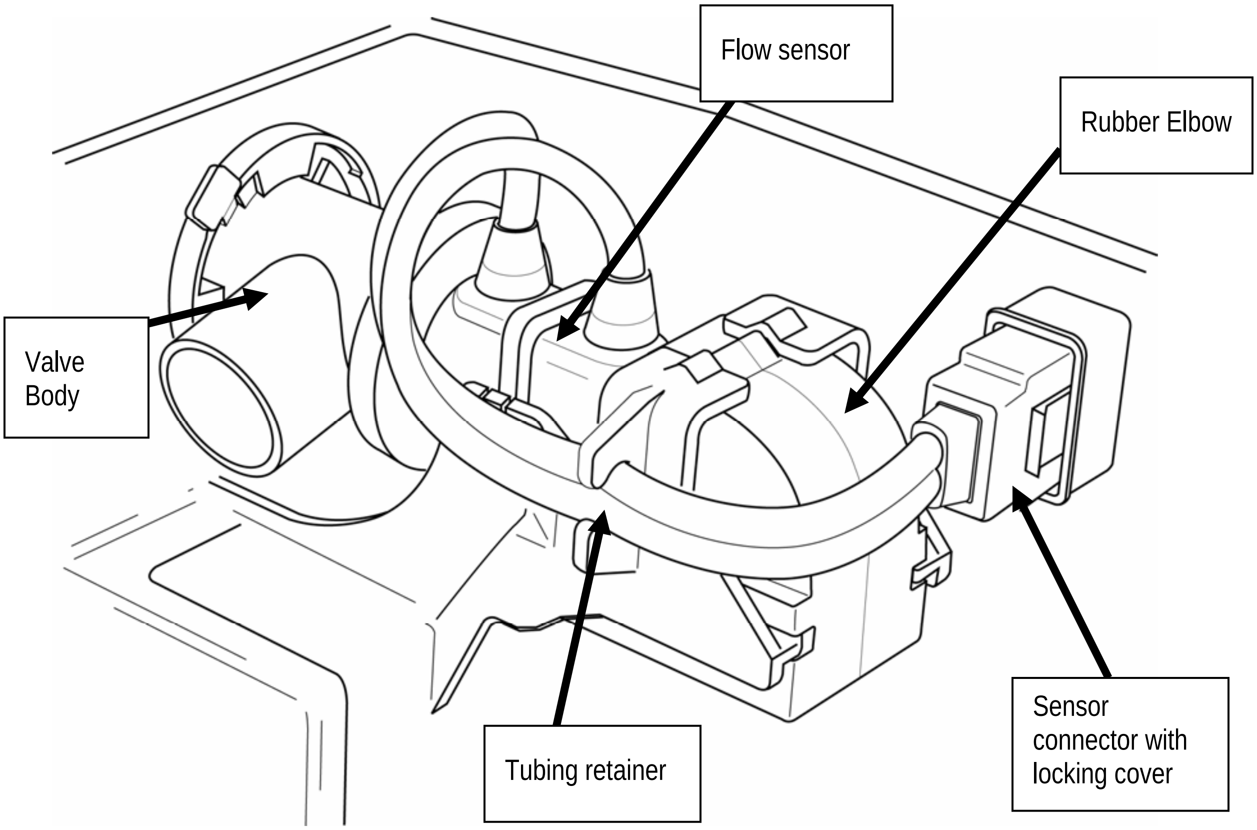

Flow sensor
Rubber Elbow
Valve Body
Tubing retainer
Sensor connector with locking cover

Figure 8.8 Exhalation assembly

Unplug the sensor connector from the receptacle taking care to retract the locking shroud as you do so.

Loosen the tubing form the tubing retainer.

Grasp the rubber elbow and pull firmly out towards the front of the AVEA. This will expose the flow sensor. Set the rubber elbow aside.

Gently free the flow sensor from the exhalation valve body and pull out towards the front of the AVEA. This will leave the valve body in place.

To remove the valve body, press down on the lever shown in figure 8.9, turn the valve body counter clockwise until the fins of the locking mechanism release and pull out. This will expose the membrane.

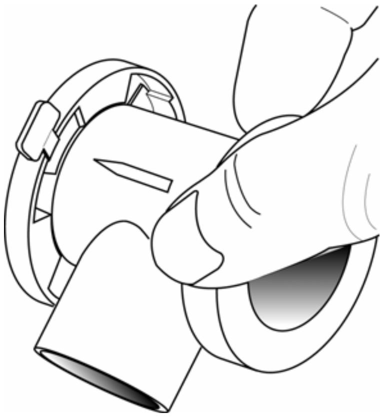


Figure 8.9 Disengage valve body

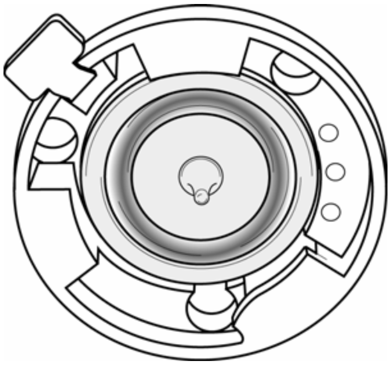
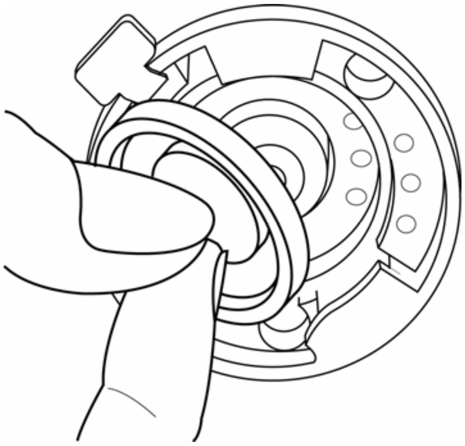


Figure 8.10 Membrane seated in the valve body.



To remove the membrane, grasp the nipple and gently pull away from the valve body.

Figure 8.11 Removing the membrane

Replace the membrane and press gently into the valve body making sure that the edges are well seated .

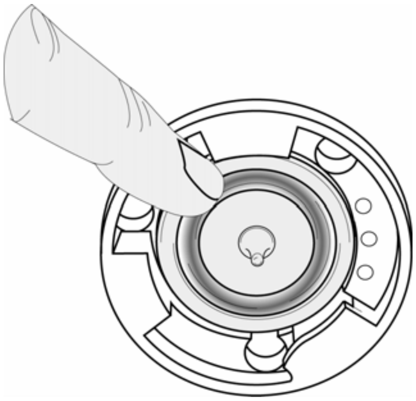


Figure 8.12 Seating the new membrane

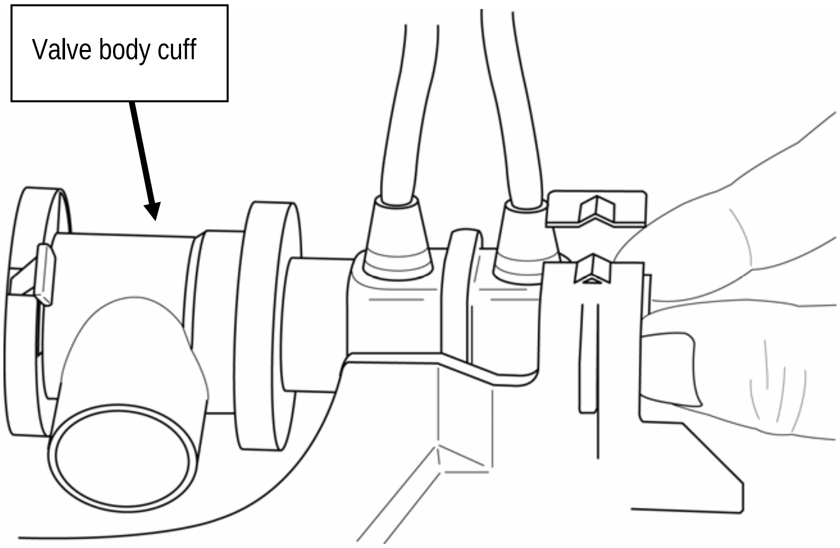


Figure 8.13 Insert the flow sensor

Grasp the flow sensor by the smaller diameter orifice and insert into the cuff on the valve body.

Push the rubber elbow onto the smaller end of the flow sensor taking care to align the groove on each side with the corresponding rail of the molded holder.

When the elbow is correctly installed, the molded protrusion on the top lines up with the protrusions on each side of the holder.

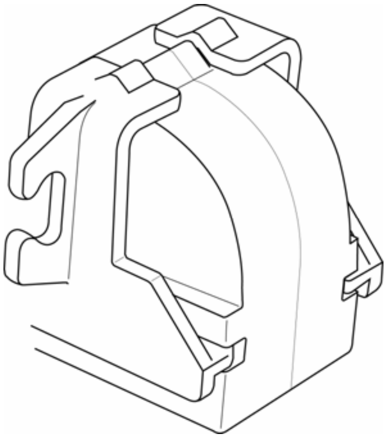


Figure 8.14 Align rubber elbow.

Reconnect the sensor and insert the two tubes into the tubing retainer.

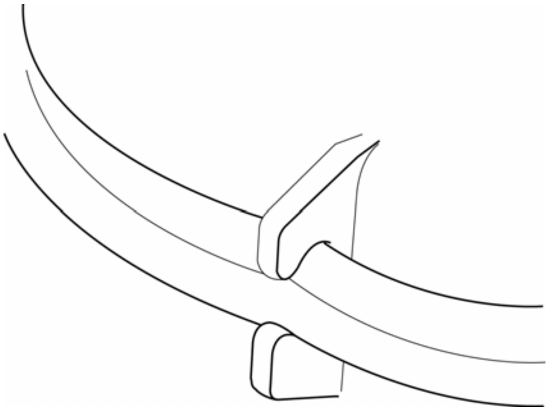


Figure 8.15

Replace the exhalation assembly cover and top cover. Replace & reconnect the UIM.

Run OVP tests after any part replacement.

Chapter 9 Troubleshooting

This section describes how to troubleshoot the ventilator if:

- The ventilator does not turn on properly.
- A Vent Inop occurs when you turn on the ventilator.
- An Operational Verification Test fails.
- A malfunction occurs.

If the Ventilator Does not Turn ON

If you turn the power switch ON and the ON indicator does not illuminate, perform the troubleshooting procedures given in Table 5.1.

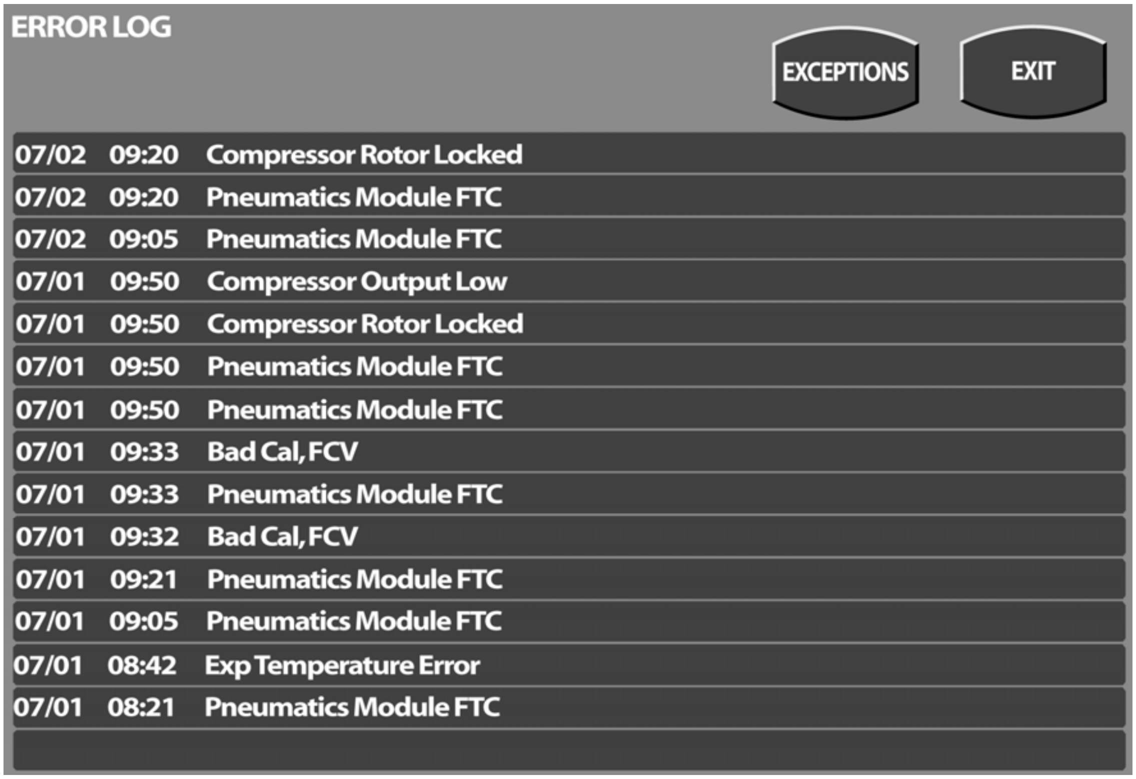
Table 9-1 Troubleshooting Power-Up Problems

PROBLEM	POSSIBLE CAUSE	ACTION
Ventilator plugged into an AC source but does not power up.	No power at AC outlet or the AC Line Voltage switch is set to the wrong voltage. *	Try connecting to a known good AC power source. Insure that the voltage setting of the ventilator matches the voltage of your power source. Check the fuse assembly if the ventilator still does not power up, Contact your Bird Products Certified Service Technician. *
Ventilator attached to alternate external DC power source but does not power up.	If the external source is a battery, the battery may not be charged. *	Plug the ventilator into a known good AC source, or to a known good battery and see if it powers up. *

If a Vent Inop alarm occurs.

Remove the ventilator from service and contact VIASYS Healthcare Technical Support.

You may be asked to check the error log. To do this, power up the ventilator with the SETUP key depressed. When the SERVICE FUNCTIONS screen appears, press ERROR LOG. The following screen appears listing all error codes chronologically with the latest occurring at the top.

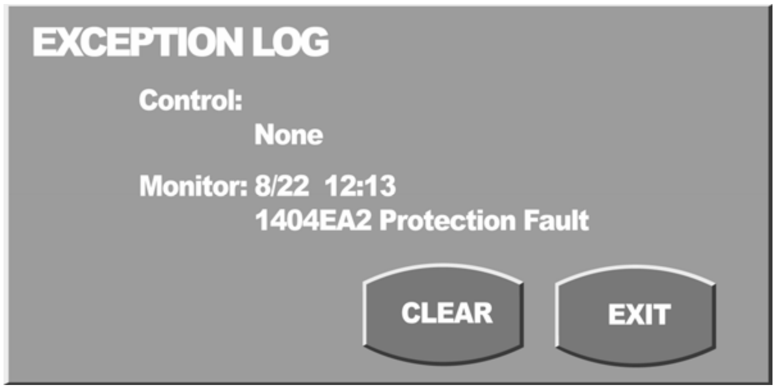


```
07/02   09:20   Compressor Rotor Locked
07/02   09:20   Pneumatics Module FTC
07/02   09:05   Pneumatics Module FTC
07/01   09:50   Compressor Output Low
07/01   09:50   Compressor Rotor Locked
07/01   09:50   Pneumatics Module FTC
07/01   09:50   Pneumatics Module FTC
07/01   09:33   Bad Cal, FCV
07/01   09:33   Pneumatics Module FTC
07/01   09:32   Bad Cal, FCV
07/01   09:21   Pneumatics Module FTC
07/01   09:05   Pneumatics Module FTC
07/01   08:42   Exp Temperature Error
07/01   08:21   Pneumatics Module FTC
```

Figure 9-1 Error log

If there is more than one page of error codes, you can scroll through them using the Data Dial. In this way, you can print a page-by page record of the codes for reference or reporting purposes.

When you have captured this information, press the Exceptions key. The EXCEPTION LOG appears.



```
Control:
        None
Monitor: 8/22  12:13
        1404EA2 Protection Fault
```

Figure 9-2 Exception Log

In the event of a fatal error, in either the Control or the Monitor processor, the date, time and address will be recorded here. You can print this and/or record the information for reporting purposes.

When you have captured the Exception log information, press Exit. DO NOT press Clear at this time, you may need to refer to this information again, or the factory technician may need to do so if the unit is returned for repair.

List of Possible Error Codes

Note: "Error Codes" may appear with normal operation of the Avea

Abbreviations:

FTC: Fail-to-cycle

IFS: Inspiratory Flow Sensor

FCV: Flow Control Valve

EFS: Expiratory Flow Sensor

PT: Pressure Transducer

Sup: Supply

BG: Blended Gas

WFS: Wye Flow Sensor

HWFS: Hot Wire Flow Sensor

Messages:

Pneumatics Module FTC
HSSC Comm Fault
IFS Voltage Fault
TCA A/D Ref Fault
IFS A/D Ref Fault
Compressor Rotor Locked
Compressor Output Low
FCV Overcurrent Fault
DPRAM Comm Error, Mntr
DPRAM Comm Error, Ctrl
Data Error, TCA
Bad Cal, EFS PT
Bad Cal, Insp PT
Bad Cal, Exp PT
Data Error, Blender
Bad Cal, Blender
Data Error, Air Sup PT
Bad Cal, Air Sup PT
Data Error, O2 Sup PT
Bad Cal, O2 Sup PT
Data Error, BG PT
Bad Cal, BG PT
Device Not Found, IFS
Header Error, IFS
Data Error, IFS
Bad ID, IFS
Bad Cal, IFS
Device Not Found, EFS
Header Error, EFS
Data Error, EFS
Bad ID, EFS
Bad Cal, EFS
Bad Cal, FCV
Bad Model Number
Bad Cal, FiO2
Header Error, Compressor
Data Error, Compressor
Bad Cal, Compressor
Invalid Feature, EPM
Header Error, EPM
Data Error, EPM
Bad Cal, WFS PT
Bad Cal, Esoph PT
Bad Cal, Aux PT
Bad Sensor Type, HWFS
Header Error, HWFS
Data Error, HWFS
Bad ID, HWFS
Bad Cal, HWFS
Header Error, WFS
Data Error, WFS
Bad ID, WFS
Bad Cal, WFS
Settings Lost
Config Lost
Insp Temperature Error
Exp Temperature Error
Bad ID, Ctrl PCB
Header Error, Ctrl PCB
Bad ID, TCA
Header Error, TCA
Bad ID, Power PCB
Header Error, Power PCB
Bad ID, Blender
Header Error, Blender
Bad ID, Air Supply PT
Header Error, Air Sup PT
Bad ID, O2 Supply PT
Header Error, O2 Sup PT
Bad ID, BG PT
Bad Header, BG PT
Trend Data Lost
Event Log Data Lost
Compressor Runtime Data Error

Table 9.2: AVEA Mechanical Troubleshooting

! Remove ventilator from patient with any potential problem

! Check error log (and exceptions) with any "Device Error" message on screen

1. Battery/Power Supply

* Insure unit is plugged in between patient use.

* Refer to service manual for proper battery discharge/charging procedures.

* Check all cables/connections and voltages before replacing parts..

Symptom	Problem	Solution(s)
Unit will not power up	Blown/incorrect/missing A/C fuse(s) Loose Internal Connection(s) Bad Power Switch Bad Power supply Bad Power Driver PCB UIM problem	Check/replace A/C fuses Check all connections Replace Power Switch Replace Power supply Replace Power Driver PCB (GDE) Check UIM cable. Refer to "UIM/Control" section
No battery indication (LED)	Excessively discharged battery state Blown/Missing batt fuse Loose connections Bad Battery PCB Bad LED indicator panel Bad battery Transition Board fault	Charge properly-refer to service manual Check/replace fuse Check connections Replace Battery PCB Replace LED indicator panel Check/replace battery Replace Transition Board
Will not charge past yellow	Excessively discharged battery state Loose connections Bad Battery PCB Bad battery Bad Power Driver PCB	Charge properly-refer to service manual Check connections Replace Battery PCB Check/replace battery Replace Power Driver PCB (GDE) Cycle battery pack by charging and discharging three times.
Decreased run time on battery (internal/external)	Excessively discharged battery state Loose connections Bad Battery PCB Bad battery Bad Power Driver PCB	Charge properly-refer to service manual Check connections Replace Battery PCB Check/replace battery Replace Power Driver PCB (GDE) Cycle battery pack by charging and discharging three times.
Unit wont run on battery (internal/external)	Blown/missing battery fuse Loose connections Bad battery	Check/replace fuse Check connections Check/replace battery

Symptom	Problem	Solution(s)
	Bad Power PCB	Replace Power PCB (GDE)
Unit does not run on A/C	Wiring disconnect Defective Power Entry Module Power supply is not recognizing A/C	Check all connections-especially by compressor Replace Power Entry Module Replace Power supply
Excessive battery heat (internal only)	Battery PCB improperly wired Bad battery PCB Bad thermal fuse Bad battery	Check wiring Replace Battery PCB Check/replace battery Check/replace battery
Flickering LED	Excessively discharged battery state Loose connections Bad power driver PCB Transition Board fault	Allow to charge-should self-resolve Check connections Replace power driver PCB (GDE) Replace Transition board
Alarms when Unit is "off"	Excessively discharged battery State Bad LED indicator panel	Allow to charge Replace LED indicator panel
LED red to green - no yellow (external battery only)	Can occur normally with ext battery charge	Perform discharge/recharge cycle
External battery not detected	System not detecting external battery	Plug unit into A/C. Connect external battery. Then, turn unit on.

2. Compressor

! All symptoms below assume NO wall air in use

* Compressor/Board must be replaced together on older units

* Check all cables and connector before replacing parts.

No compressor function (and no indicator)	Standard unit - without compressor Bad Air Calibration Bad Blended Gas Calibration Blown fuse on compressor PCB Bad compressor PCB	Option on AVEA 200 Check Air Calibration Check Blended gas Calibration Replace compressor PCB Replace compressor PCB
No compressor function (indicator present)	Unit is reading air pressure with none present.	Blown Air Pressure Transducer. See Pneumatic troubleshooting
"Loss of gas" alarms without O2 in use	Low compressor output Compressor leak Accumulator depletion	Check output - replace compressor if necessary Check tubing/connections Check for excessive patient minute

Symptom	Problem	Solution(s)
		ventilation
"Loss of air" alarms with O2 in use	Low compressor output Compressor leak Accumulator depletion	Check output - replace compressor if necessary Check tubing/connections Check for excessive patient minute ventilation
Excessive compressor noise/vibration	Incorrect mounting Defective/worn Vibration dampeners	Insure mounting nuts are present and tightened Replace Vibration dampeners

3. EPM

! All symptoms below apply to WFS, Esoph and Aux - unless otherwise noted.

* Available in AVEA Comprehensive only

* Paux and Pesoph not available in software ver 2.7

Erroneous readings from sensor	Bad Sensor Transducer(s) out of calibration Leak	Change/Replace sensor Recalibrate Check all internal/external connections
No reading from sensor	Bad sensor (cable/connector) Specified transducer out of cal No communication from EPM	Try different sensor Check error log for specific transducer. Recalibrate Check internal connections. Replace EPM if needed
"Device Error" when sensor connected	Bad sensor (cable/connector) Specified transducer out of cal No communication from EPM	Try different sensor Check error log for specific transducer Recalibrate Check internal connections. Replace EPM if needed

4. Exhalation Valve/Assembly

Low measured exhaled volumes	Internal leak External leak	Re-seat GDE Check all circuit connections Check filter assembly Check/Replace exhalation diaphragm
Will not pass EST "leak test"	Internal leak External leak	Re-seat GDE Check all circuit connections Check filter assembly Check/Replace exhalation diaphragm
Valve noise	Diaphragm is out of position	Clean/re-seat diaphragm
Excessive expiratory resistance	Moisture in Exhalation Filter Clogged/Dirty Exhalation diaphragm	Bypass filter and recheck. Replace if necessary Clean/replace diaphragm

Symptom	Problem	Solution(s)
Abnormal expiratory waveforms	Bad expiratory valve	Replace valve

5. Flow Sensors (inc. Wye)

* See TCA/PCB troubleshooting for additional information		
Volumes become inaccurate over time	Foreign material on flow sensor Expiratory or Wye flow out of calibration-depending on sensor used	Clean/replace sensor as needed Re-calibrate and recheck volumes
No reading from external variable orifice sensor	Sensor not active in certain modes Loose external connection/Bad Sensor Loose internal connection Communications error	See operators manual for correct sensor/mode configurations Check external connection/replace sensor Check all cables/connections See "EPM" troubleshooting section
No reading from internal variable orifice sensor	Loose external connection/Bad Sensor Loose internal connection Communications error	Check external connection/replace sensor Check all cables/connections Replace TCA/PCB (GDE)
No reading from external heated wire sensor	Sensor not active in certain modes Loose external connection/Bad Sensor Loose internal connection Communications error	See operators manual for correct sensor/mode configurations Check external connection/replace sensor Check all cables/connections Replace TCA/PCB (GDE)
Volume reading above baseline on test lung	Normal condition. Unit expects gas at BTPS, not ATPD	N/A
Volume reading above/below baseline on patient (internal sensor)	Humidifier "Active on/off" set incorrectly Bad Flow sensor Expiratory flow out of calibration Bad pressure transducer	"Active on" for humidifier, "Active off" for HME Check for correct zero with Wye sensor. If Wye sensor zeros correctly, recalibrate Expiratory flow and recheck. Replace internal sensor if needed. If Internal/external sensors both zero incorrect after recal, bad pressure transducer-replace (GDE)

6. Nebulization System

Nebulizer output absent	Unit running on compressor or flow < 15 L/min Bad Nebulizer Solenoid Transition PCB- bad harness connection Problem on Power PCB	Connect wall air, increase flow (if applicable) Replace Solenoid Replace Transition PCB (if solenoid doesn't fix)* Replace Power PCB (if solenoid doesn't

Symptom	Problem	Solution(s)
		fix)*
Nebulizer output reduced/absent	Neb booster output low Kinked tubing externally Kinked tubing internally Bad Neb Booster Solenoid	Adjust Neb booster output Check/replace tubing to nebulizer Check unit for kinks or disconnects Replace Solenoid

* Check Voltage at Solenoid (both). Should be 12v/0v while running with cycling heard. If voltage problem is seen - suspect problem at areas.

With "*"

7. O2 Sensor

"***" on Fi02 monitor	Fi02 reading out of upper or lower range	Run EST with 50 psi oxygen source connected. Recalibrate/replace sensor
O2 reading inaccurate	Fi02 sensor out of calibration Blocked sensor orifice Malfunctioning Blender Assembly.	Run EST with 50 psi oxygen source connected. Recalibrate/replace sensor Insure patentcy of orifice Replace Blender Assy (GDE)
O2 will not read	Bad 02 sensor Bad 02 sensor cable TCA board problem	Replace sensor Replace sensor cable Replace TCA board (GDE)

8. Pneumatic System

! Check error log (and exceptions) with any “Device Error” or “Inop” condition to diagnose component.

Component	Symptom	Problem	Solution(s)
Air Pressure PCB	Vent Inop. (communications failure)	Bad connections/cable EPROM failure Incorrect calibration	Check connections/replace cable Replace Air PCB-recalibrate Recalibrate
	Incorrect pressure reading	Bad Transducer Incorrect calibration	Replace Air PCB-recalibrate Recalibrate
02 Pressure PCB	Vent Inop. (communications failure)	Bad connections/cable EPROM failure Incorrect calibration	Check connections/replace cable Replace 02 PCB-recalibrate

Component	Symptom	Problem	Solution(s)
			Recalibrate
	Incorrect pressure reading	Bad Transducer Incorrect calibration	Replace 02 PCB Recalibrate
Blended Gas PCB	Vent Inop. (communications failure)	Bad connections/cable EPROM failure Incorrect calibration	Check connections/replace cable Replace Blended Gas PCB-recalibrate Recalibrate
	Incorrect pressure reading	Bad Transducer Incorrect calibration	Replace Blended Gas PCB-recalibrate Recalibrate
Blender	Vent Inop.	Bad connections/cable EPROM failure Incorrect calibration	Check connections/replace cable Replace Blender (GDE) Recalibrate
	Fi02 Inaccuracy	Blender Assembly Failure Regulator Relay out of balance Leak	Replace Blender (GDE) Recalibrate Regulator Relay Check all pneumatic connections
Flow Control Valve	Inspiratory Noise	FCV out of characterization Defective FCV	Re-characterize FCV * Replace FCV (GDE)
	Flow Abnormalities	FCV out of characterization Defective FCV	Re-characterize FCV * Replace FCV (GDE)
Inspiratory Flow Sensor	Autocycling	Leak at FCV/IFS Bad IFS	Check all connections Replace IFS (GDE)
	Incorrect delivery	Leak at FCV/IFS Bad IFS	Check all connections Replace IFS (GDE)
	Vent Inop	Bad Connection/cable Bad IFS	Check all connections/replace cable Replace IFS (GDE)
Safety Relief Valve	Breath delivered-no output to patient	Leak in safety solenoid tubing/connections Bad safety solenoid Problem in TCA board	Check all connections " Replace safety solenoid

Component	Symptom	Problem	Solution(s)
			Replace TCA (GDE)
	Mechanical overpressure release prematurely	Incorrect Setting	Reset overpressure setting * (replace)

All items marked with an "*" are done at factory.

9. UIM/Control System

Symptom	Problem	Solution(s)
Unit continues to run after being switched off	Disconnected wire on "on/off" switch Bad "on/off" switch	Check wiring in GDE Replace switch
No power to unit and UIM	Fuse/power supply problem	See "Battery/Power supply section"
Unit powers on-UIM doesn't	Damaged/disconnected cable-Ext./Int. Bad Backlight Inverter Blown fuse on TCA Bad TCA Power supply voltage drops w/load	Check/replace all external and internal cables/connections Replace Backlight Inverter Replace fuse Replace TCA (GDE) Replace Power Supply
Membrane buttons not working	"Screen lock" button active Loose connections/bad cable Defective membrane switch assembly	Unlock screen Check all cables/connections Replace switch assembly (UIM)
Touch screen not working	Loose internal connection Defective touch pad	Check all internal cables/connections Replace touch pad (UIM)
No priority LED's	Bad LED PCB	Replace LED PCB
Optical Encoder (knob) inoperable	Bad Optical Encoder	Replace Optical Encoder
No sound with alarms	Speaker wire loose/disconnected Bad speaker Bad TCA	Check wiring to speaker Replace speaker Replace TCA board (GDE)

Chapter 10 Parts List

Note

The list of components given in this manual are for reference only. For a comprehensive part list contact VIASYS Respiratory Care Technical Support.

Description	Part Number
A/C BRACKET	51000-40728
ACCUMULATOR	51000-40748
ADULT PT. CIRCUIT 48”	16044
ADULT PT. CIRCUIT 72”	16045
ADULT TEST LUNG (SIEMENS)	33754
AIR “SMART” CONNECTOR DISS	51000-40897
AIR AND HELIOX TETHERED “SMART” CONNECTOR	DISS P/N 16131 NIST P/N 16132
ALARM SPEAKER	51000-40818
COMPREHENSIVE CART	33976
COMPRESSOR/SCROLL PUMP ASSEMBLY (INCLUDES PCBA)	51000-09750A
CUSTOM TRANSPORT CART KIT	11372
Rack, tank, cart assembly	33978
12V/12 amp lead acid battery (set of 2)	16179
Battery tray (screw, washer, nut)	33977
Wire harness	16217
EPM BOARD (INCLUDES PCBA)	51000-40848A
EXHALATION CORNER	
Exhalation filter cartridge (holds filter)	51000-40640
Filter capsule (non-disposable)	33987
Water trap assembly	50000-40035
Water trap adapter	22095
Bottle, 125 ml.	33985
EXHALATION VALVE ASSEMBLY	16319A
EXHALATION FLOW SENSOR ASSEMBLY	51000-40023
Elbow, orange	51000-40525
EXTERNAL BATTERY (2 pack)	16179
FAN/CABLE ASSEMBLY	51000-40861
FRONT INTERFACE PANEL, PNEUMATIC MODULE	51000-40635
GDE	16222A
Cable assembly, battery upgrade	16243

Description	Part Number
HEATER ASSEMBLY Bracket, thermal fuse	51000-40824 22018
HELIOX “SMART” CONNECTOR DISS	51000-40918
HELIOX 15 FT. HOSE	50000-40042
INFANT TEST LUNG (INGMAR)	34057
INTERNAL BATTERIES Fuse (10 amp slow blow) Fuse holder A/C	68339A 71690 68159
NEBULIZER ASSEMBLY	51000-40026
POWER DRIVER BOARD, PCBA, REV C	52290
POWER ENTRY MODULE	51000-40827
POWER SUPPLY KIT Power supply Sense cable	16230A 16388 16366
SECONDARY ALARM ASSEMBLY KIT	16316
STANDARD CART	15986
TCA BOARD, PCBA Fuse	51000-40310A 56000-20072
TOP COVER MICROSWITCH	68294
TRANSITION BOARD WITH HARNESS	16216
UIM ARM ASSY FRONT COVER	51000-40623
UIM ARM ASSY REAR COVER	51000-40622
UIM DOMESTIC	16259
UIM INTERNATIONAL	16260
UIM MOUNTING ARM ASSEMBLY	51000-40072

Calibration Tool Kit
Part No. 03440

Description	Part Number
1/4 “ silicone tubing	54980-01903
8F Catheter assembly	3001083
Adult wye flow sensor (Var-Flex disposable)	51000-40094
Calibration syringe	51000-09558
Connector, aux port; proximal	51000-40096
Detail assy O2 reg adj tool	51000-08258
Filter removal tool	21735
Ftg. DISS, air, male ¼ NPT	52000-00133
Ftg. Fem. R/A Elbow 12mm OD	32002
Ftg. O2, ¼ MPT x 9/16 male	52000-00132
Luer lock, male 1/16 dia	52000-01205
RS232 printer cable (for downloading software)	71555
Tube ftg. 1/8 to 1/16 dia reducer	32040
Tube ftg. Tee 1/16 x 1/16 x 1/8 dia	32067
Tube ftg. Tee 1/16 x 1/18 x 1/18 dia	52000-01193
Tubing, poly 12mm OD	33980

In addition, with comprehensive software, you will need:	
Esophageal catheter extension tube (10 pack)	50000-09920
Adult esophageal catheter (8F)	7003100 &/or
/ Pediatric esophageal catheter (6F)	7003401
3.0 and high software rev, you will need:	
Tool, Exhalation Valve Characterization	10136

Preventive Maintenance Kits

Description	Part Number
PREVENTIVE MAINTENANCE KIT WITHOUT COMPRESSOR	16137
Exhalation diaphragm	16240
Filter, inlet tube (PM requires 2 ea.)	33951
Filter, fan (5 pack)	71670
PREVENTIVE MAINTENANCE KIT WITH COMPRESSOR	16138
Compressor inlet filter	33928
Compressor outlet filter	33929
Exhalation Diaphragm	16240
Filter, inlet tube (PM requires 2 ea.)	33951
Filter, fan (5 pack)	71670
FILTER REMOVAL TOOL	21735
Note: The exhalation diaphragm may be ordered separately in a package of 10 P/N 16240D	

Communications

Description	Part Number
Cable tie	07803
GSP Interface Kit	16375
Independent Lung Ventilation (ILV) Cable Kit	16124 16246
Phillips Vue Link cable	16337
Remote Nurse Call Cable/Normally Closed	15620
Remote Nurse Call Cable/Normally Open	15619

Accessories

Description	Part Number
Bottle, 125 ml.	33985
Disp. neonatal flow sensor (10/pkg)	50000-40038
Disp. Neonatal flow sensor (each)	51000-40098
Disposable adult flow sensor (10/pkg)	50000-40031
Disposable expiratory filter (12/pkg)	11395
F & P pole mount kit	69302
Filter capsule (non-disposable)	33987
Neonatal Hot Wire Flow Sensor	51000-40081
Oxygen sensor (with connector)	68289
Patient circuit support arm	10128
Proximal adapter (required for proximal pressure monitoring)	51000-40096
Support Arm Rail Clamp	52000-30101
Talced Diaphragm/poppet (10/pkg)	16240D
Tube hanger	51000-02736
Water trap assembly	50000-40035

MONITORING PROCEDURES DISPOSABLE ACCESSORIES (EACH ORDER IS IN A PACKAGE OF 10)

Description	Part Number
Adult esophageal catheter 8 FR	7003100
Bicore accessories kit	16401
Esophageal catheter extension tube	50000-09920
Pediatric esophageal catheter 6 FR	7003401
Tracheal catheter 5 FR. Disposable	10635
Tracheal catheter adapter	50000-40034
Tracheal catheter extension tube	50000-40040

Product Literature

Description	Part Number
Modes Book	L2190
Operator’s Manual (ENG)	L1523
Quick Tips Card (adult)	L2290
Quick Tips Card (infant)	L2291
User’s Guide (ENG)	L2042

Appendices

Contact & Ordering Information

How to Call for Service

To get help on performing any of the preventive maintenance routines, or to request service on your ventilator, contact VIASYS Respiratory Care Customer Care:

Technical Service

Hours: 7:00 AM to 3:30 PM (PST) Monday through Friday
Phone: (800) 231-2466
Fax: (714) 283-8471

VIASYS Respiratory Care Customer Care Helpline

Hours: 24 hours, seven days a week

Phone: (800) 231-2466 (From within the US)

Ordering Parts

To obtain AVEA Ventilator parts contact customer service at:

VIASYS Respiratory Care Customer Service:

Hours: 7:00 Am to 3:30 PM (PST)
Monday through Friday

Phone: (800) 231-2466

Fax: (714) 283-8473
(714) 283-8493

Diagrams and Schematics

The drawings and schematics presented in this manual are for reference purposes only. It is possible that later versions of these documents may become available after this manual print date. VIASYS Respiratory Care will provide upon request and to qualified persons any and all diagrams, technical drawings and other information necessary to repair, maintain or service the AVEA Ventilator systems. Contact VIASYS Respiratory Care technical support or your local VIASYS Respiratory Care representative for information.

AVEA Schematics

51000-40652	LED BOARD
51000-40702	HOURMETER
51000-40342	INSPIRATORY FLOW VALVE
51000-40292	O2 BLENDER
X51000-40332	EPM BOARD
50572	PATIENT ASSIST CALL
52252	CONTROL, PCBA, 32 BIT
51000-40552	PCBA, DRIVER TRANSITION
52292	PCBA, POWER DRIVER BOARD
52172	PCB COMPRESSOR WITH CONNECTORS
51000-40362	PCBA, SUPPLY PRESSURE
51000-40312	TRANS COM ALARM
51000-40370	PCBA, BLENDED GAS
68273	POWER SUPPLY

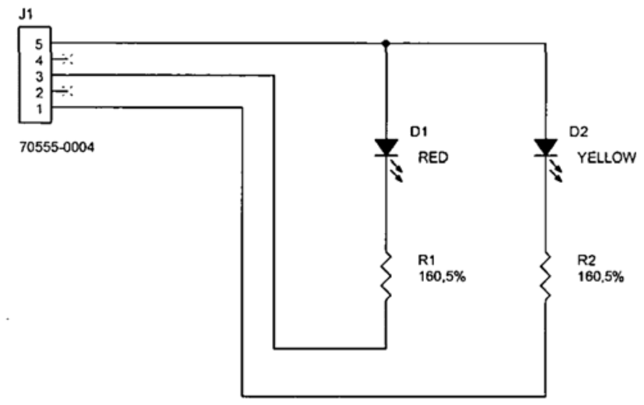
AVEA Diagrams

51000-40431	PCBA, EXHALATION FLOW TRANSITION
52331	PCBA, BACKUP ALARM
51000-40841	TUBING DIAGRAM
51000-09742	PNEUMATIC DIAGRAM
21891	WIRING DIAGRAM

LED Board

REVISION HISTORY					
REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56908	PILOT RELEASE PER ECO	RJ HALES	MVN	9.5.01
A	57359	PRODUCTION RELEASE PER ECO	RJ HALES		1/3/02

HL



QTY REQD	PART OR IDENTIFYING NO.	NOMECLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◄— DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XX ±.02 .XXX ±.005 ANG ±1.00°
C. MACH SURFACES 32 ✓ OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	R.J. HALES	8.22.01
CHECKED	MV NORTH	9.5.01
APPROVED	S LANDAS	9.7.01
RELEASED	J NELSON	9.5.01

VIASYS™
HEALTHCARE
CRITICAL CARE DIVISION

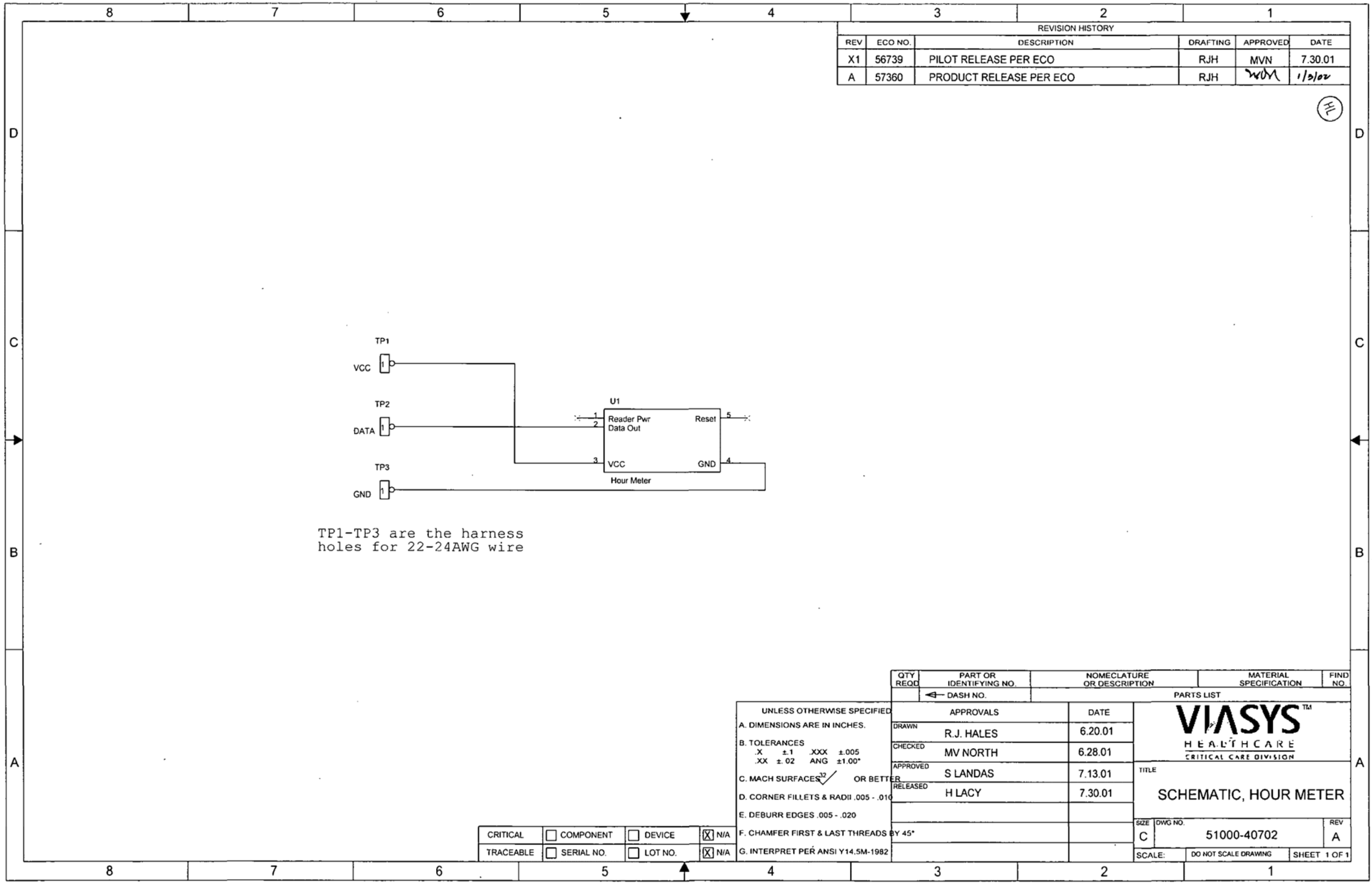
TITLE
SCHEMATIC, LED BOARD

SIZE	DWG NO.	REV
C	51000-40652	A

SCALE: DO NOT SCALE DRAWING SHEET 1 OF 1

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

Hour Meter



TP1-TP3 are the harness
holes for 22-24AWG wire

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56739	PILOT RELEASE PER ECO	RJH	MVN	7.30.01
A	57360	PRODUCT RELEASE PER ECO	RJH	WDM	1/3/02

QTY REQD	PART OR IDENTIFYING NO.	NOMECLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◁— DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.02 ANG ±1.00°
C. MACH SURFACES 32✓ OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	R.J. HALES	6.20.01
CHECKED	MV NORTH	6.28.01
APPROVED	S LANDAS	7.13.01
RELEASED	H LACY	7.30.01

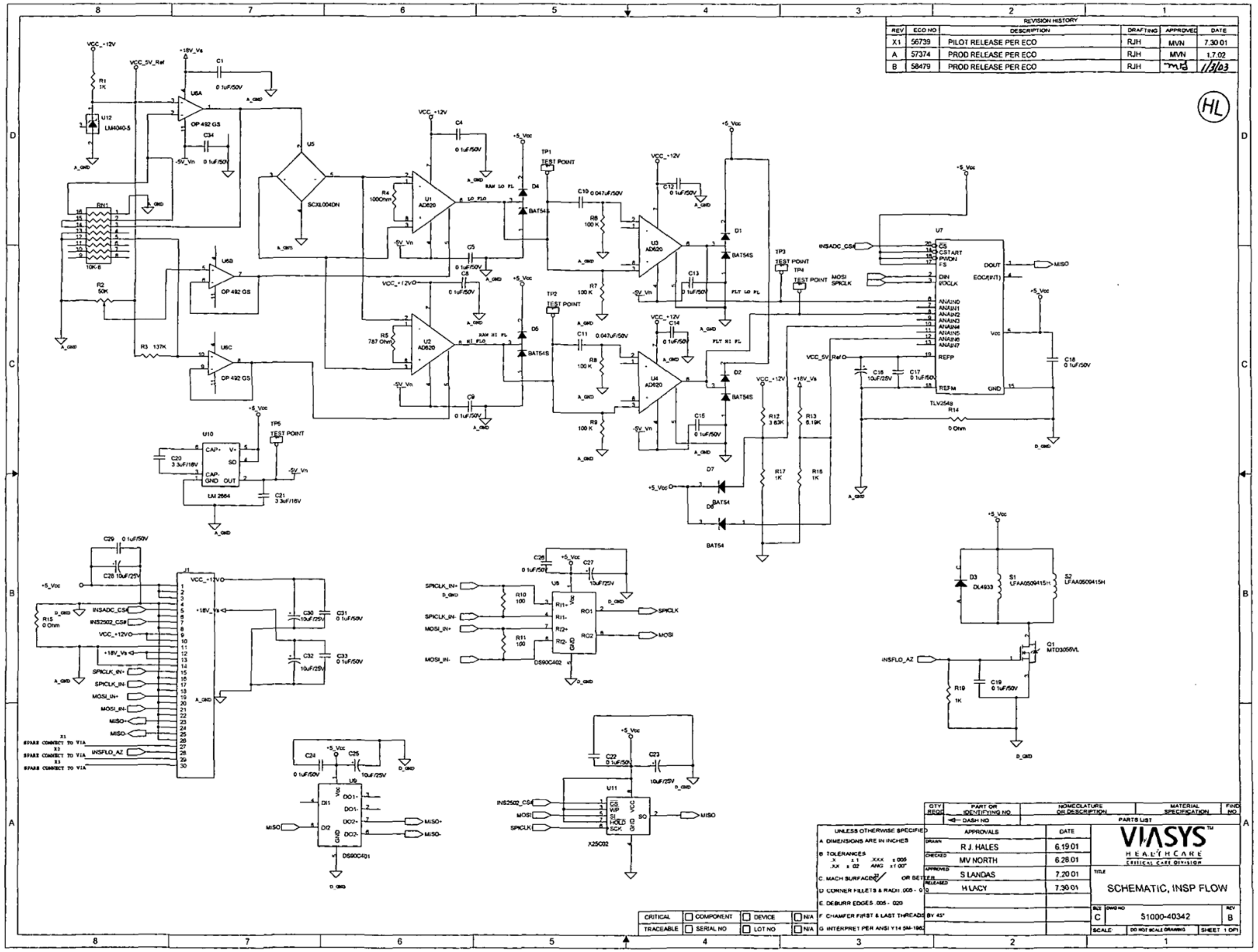
CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION

TITLE
SCHEMATIC, HOUR METER

SIZE C
DWG NO. 51000-40702
REV A
SCALE:
DO NOT SCALE DRAWING
SHEET 1 OF 1

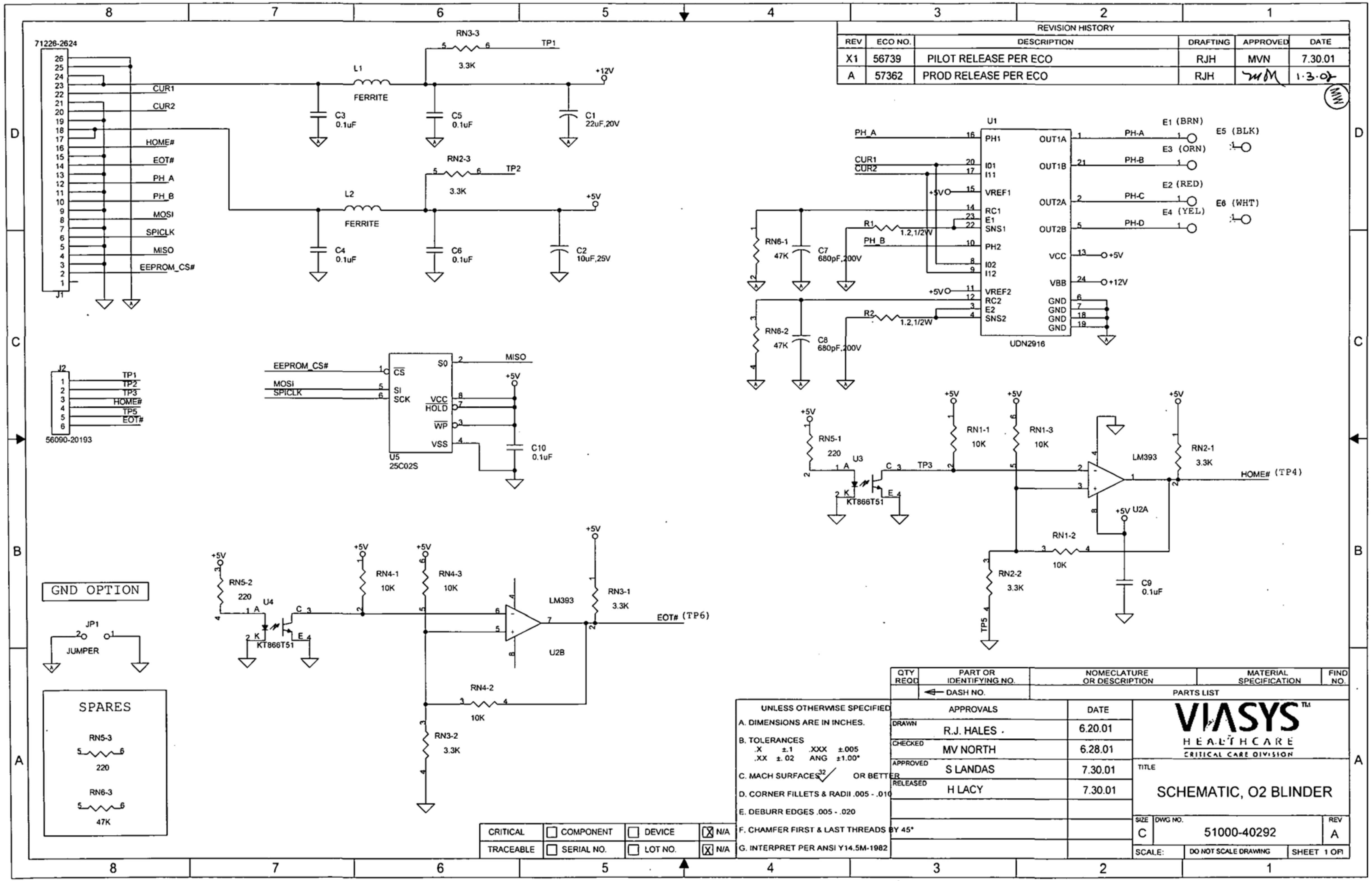
Inspiratory Flow Valve



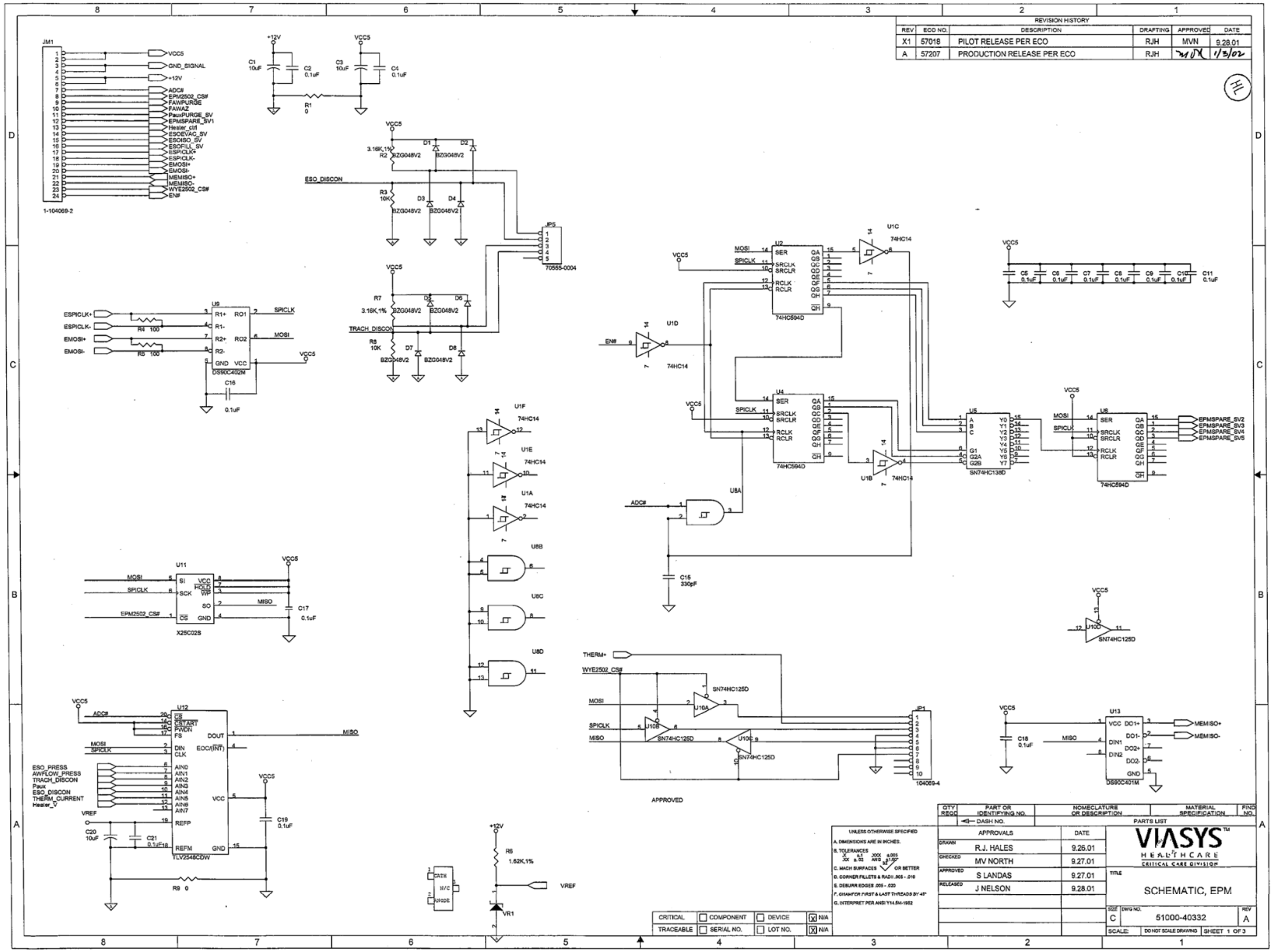
REV	ECO NO	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56739	PILOT RELEASE PER ECO	RJH	MVN	7.30 01
A	57374	PROD RELEASE PER ECO	RJH	MVN	1.7.02
B	58479	PROD RELEASE PER ECO	RJH	mrd	1/3/03

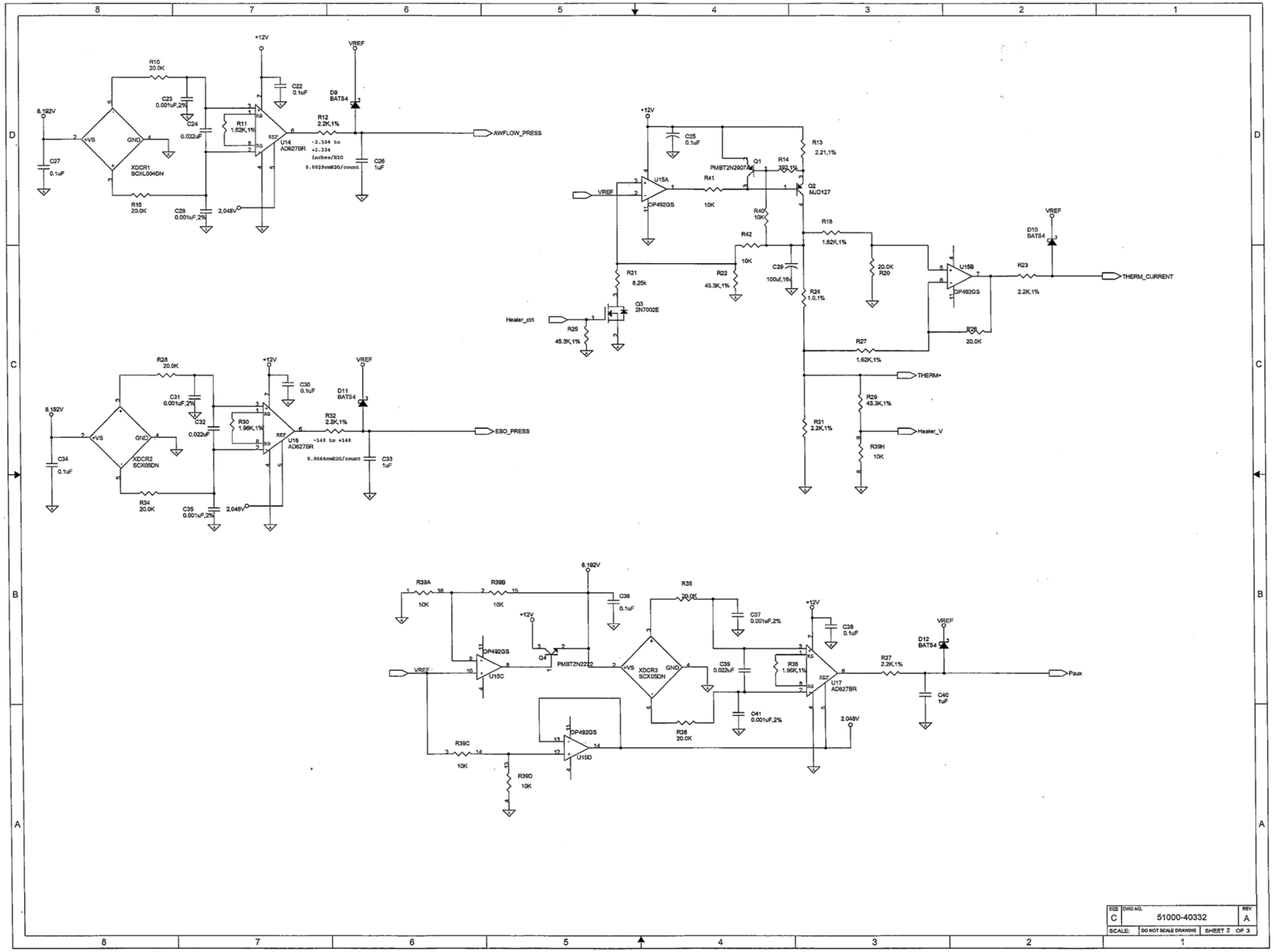
REVISION HISTORY
HL
VCC_+12V
VCC_5V_Ref
+18V_Vs
R1 1K
U12 LM4040-5
U6A OP 492 GS
C1 0.1uF/50V
C34 0.1uF/50V
-5V_Vn
A_GND
D_GND
U5 SCXL004DN
RN1 10K-8
U6B OP 492 GS
U6C OP 492 GS
R2 50K
R3 137K
R4 1000hm
U1 AD620
R5 787 Ohm
U2 AD620
C4 0.1uF/50V
C5 0.1uF/50V
C8 0.1uF/50V
C9 0.1uF/50V
+5_Vcc
TP1 TEST POINT
TP2 TEST POINT
D4 BAT54S
D5 BAT54S
RAW LO FL
RAW HI FL
C10 0.047uF/50V
C11 0.047uF/50V
R6 100 K
R7 100 K
R8 100 K
R9 100 K
U3 AD620
U4 AD620
C12 0.1uF/50V
C13 0.1uF/50V
C14 0.1uF/50V
C15 0.1uF/50V
D1 BAT54S
D2 BAT54S
FLT LO FL
FLT HI FL
TP3 TEST POINT
TP4 TEST POINT
U7 TLV2548
INSADC_CS#
MOSI
SPICLK
MISO
CS
CSTART
PWDN
FS
DOUT
DIN
EOC(INT)
I/OCLK
ANAIN0
ANAIN1
ANAIN2
ANAIN3
ANAIN4
ANAIN5
ANAIN6
ANAIN7
REFP
REFM
Vcc
GND
C16 10uF/25V
C17 0.1uF/50V
C18 0.1uF/50V
R14 0 Ohm
R12 3.83K
R13 6.19K
R17 1K
R16 1K
D7 BAT54
D6 BAT54
U10 LM 2664
CAP+
CAP-
V+
SO
GND
OUT
C20 3.3uF/16V
C21 3.3uF/16V
TP5 TEST POINT
C29 0.1uF/50V
C28 10uF/25V
J1
R15 0 Ohm
INSADC_CS#
INS2502_CS#
SPICLK_IN+
SPICLK_IN-
MOSI_IN+
MOSI_IN-
MISO+
MISO-
X1 SPARE CONNECT TO VIA
X2 SPARE CONNECT TO VIA
X3 SPARE CONNECT TO VIA
INSFLO_AZ
C30 10uF/25V
C31 0.1uF/50V
C32 10uF/25V
C33 0.1uF/50V
C26 0.1uF/50V
C27 10uF/25V
U8 DS90C402
R10 100
R11 100
RI1+
RI1-
RI2+
RI2-
RO1
RO2
C24 0.1uF/50V
C25 10uF/25V
U9 DS90C401
DI1
DI2
DO1+
DO1-
DO2+
DO2-
C22 0.1uF/50V
C23 10uF/25V
U11 X25C02
CS
WP
SI
HOLD
SCK
SO
VCC
GND
D3 DL4933
S1 LFAA0509415H
S2 LFAA0509415H
Q1 MTD3055VL
R19 1K
C19 0.1uF/50V
QTY REQD
PART OR IDENTIFYING NO
NOMECLATURE OR DESCRIPTION
MATERIAL SPECIFICATION
FIND NO
DASH NO
PARTS LIST
UNLESS OTHERWISE SPECIFIED
A DIMENSIONS ARE IN INCHES
B TOLERANCES .X ±1 .XXX ±.005 .XX ±.02 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F CHAMFER FIRST & LAST THREADS BY 45°
G INTERPRET PER ANSI Y14 5M-1982
CRITICAL ☐ COMPONENT ☐ DEVICE ☐ N/A
TRACEABLE ☐ SERIAL NO ☐ LOT NO ☐ N/A
APPROVALS
DATE
DRAWN R J. HALES 6.19.01
CHECKED MV NORTH 6.28.01
APPROVED S LANDAS 7.20.01
RELEASED H LACY 7.30.01
VIASYS™ HEALTHCARE CRITICAL CARE DIVISION
TITLE SCHEMATIC, INSP FLOW
SIZE C
DWG NO 51000-40342
REV B
SCALE
DO NOT SCALE DRAWING
SHEET 1 OF 1

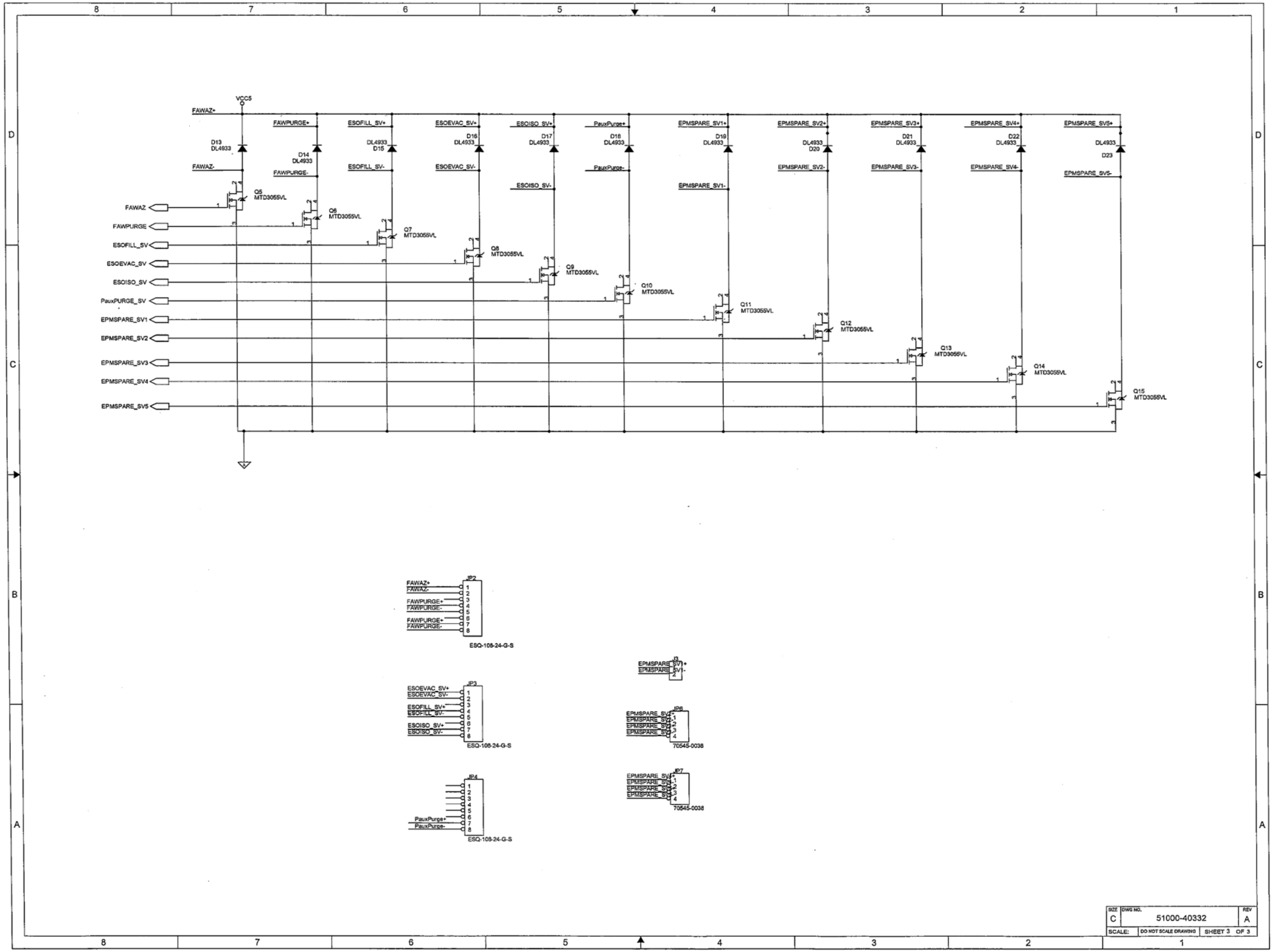
O_2 Blender


REVISION HISTORY
REV | ECO NO. | DESCRIPTION | DRAFTING | APPROVED | DATE
X1 | 56739 | PILOT RELEASE PER ECO | RJH | MVN | 7.30.01
A | 57362 | PROD RELEASE PER ECO | RJH | MVN | 1-3-02
71226-2624
J1
CUR1
CUR2
HOME#
EOT#
PH_A
PH_B
MOSI
SPICLK
MISO
EEPROM_CS#
L1 FERRITE
L2 FERRITE
RN3-3 3.3K
RN2-3 3.3K
TP1
TP2
+12V
+5V
C3 0.1uF
C5 0.1uF
C1 22uF,20V
C4 0.1uF
C6 0.1uF
C2 10uF,25V
J2
56090-20193
TP3
TP5
U5 25C02S
C10 0.1uF
U1 UDN2916
PH1 OUT1A OUT1B I01 I11 VREF1 OUT2A RC1 E1 SNS1 OUT2B PH2 VCC I02 I12 VBB VREF2 RC2 E2 SNS2 GND
R1 1.2,1/2W
R2 1.2,1/2W
RN6-1 47K
RN6-2 47K
C7 680pF,200V
C8 680pF,200V
E1 (BRN)
E3 (ORN)
E2 (RED)
E4 (YEL)
E5 (BLK)
E6 (WHT)
PH-A
PH-B
PH-C
PH-D
RN5-1 220
U3 KT866T51
RN1-1 10K
RN1-3 10K
LM393
RN2-1 3.3K
HOME# (TP4)
U2A
RN1-2 10K
RN2-2 3.3K
C9 0.1uF
GND OPTION
JP1 JUMPER
SPARES
RN5-3 220
RN6-3 47K
RN5-2 220
U4 KT866T51
RN4-1 10K
RN4-3 10K
RN3-1 3.3K
U2B
EOT# (TP6)
RN4-2 10K
RN3-2 3.3K
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | FIND NO.
DASH NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XXX ±.005 .XX ±.02 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982
APPROVALS | DATE
DRAWN R.J. HALES | 6.20.01
CHECKED MV NORTH | 6.28.01
APPROVED S LANDAS | 7.30.01
RELEASED H LACY | 7.30.01
VIASYS HEALTHCARE CRITICAL CARE DIVISION
TITLE SCHEMATIC, O2 BLINDER
SIZE C DWG NO. 51000-40292 REV A
SCALE: DO NOT SCALE DRAWING SHEET 1 OF1
CRITICAL ☐ COMPONENT ☐ DEVICE ☒ N/A
TRACEABLE ☐ SERIAL NO. ☐ LOT NO. ☒ N/A

EPM Board

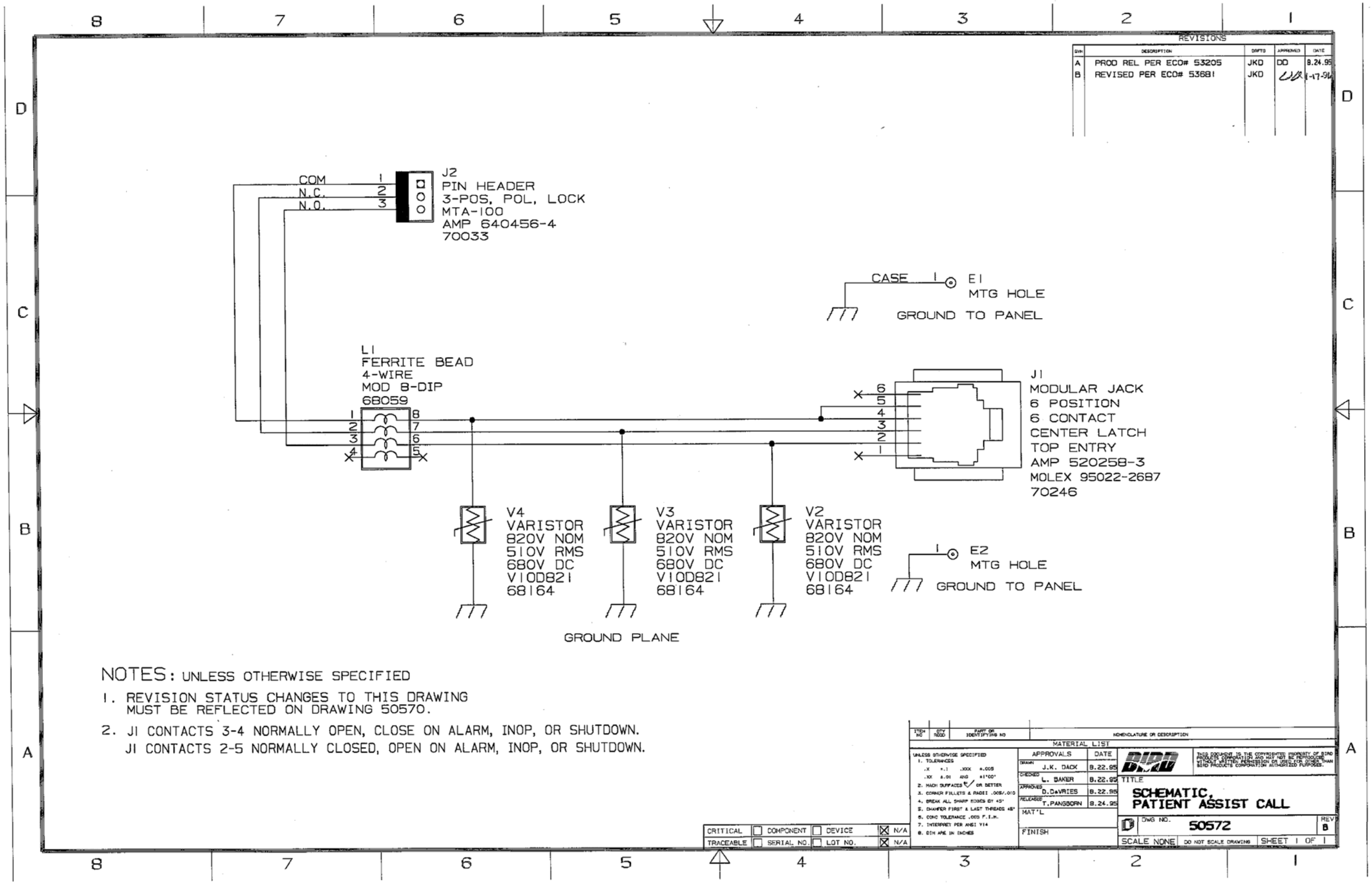

REVISION HISTORY
REV ECO NO. DESCRIPTION DRAFTING APPROVED DATE
X1 57018 PILOT RELEASE PER ECO RJH MVN 9.28.01
A 57207 PRODUCTION RELEASE PER ECO RJH 1/3/02
JM1
VCC5
GND_SIGNAL
+12V
ADC#
EPM2502_CS#
FAWPURGE
FAWAZ
PauxPURGE_SV
EPMSPARE_SV1
Heater_ctrl
ESOEVAC_SV
ESOISO_SV
ESOFILL_SV
ESPICLK+
ESPICLK-
EMOSI+
EMOSI-
MEMISO+
MEMISO-
WYE2502_CS#
EN#
1-104069-2
C1 10uF
C2 0.1uF
C3 10uF
C4 0.1uF
R1 0
ESO_DISCON
TRACH_DISCON
BZG048V2
JP5
70555-0004
U9
DS90C402M
SPICLK
MOSI
C16 0.1uF
U2 74HC594D
U4 74HC594D
U5 SN74HC138D
U6 74HC594D
U1C 74HC14
U1D 74HC14
U1F 74HC14
U1E 74HC14
U1A 74HC14
U1B 74HC14
U8A
U8B
U8C
U8D
EPMSPARE_SV2
EPMSPARE_SV3
EPMSPARE_SV4
EPMSPARE_SV5
C5 C6 C7 C8 C9 C10 C11 0.1uF
U11 X25C02S
MISO
EPM2502_CS#
C17 0.1uF
C15 330pF
U10D SN74HC125D
THERM+
WYE2502_CS#
U10A U10B U10C SN74HC125D
JP1 104069-4
U13 DS90C401M
C18 0.1uF
U12 TLV2548CDW
ESO_PRESS
AWFLOW_PRESS
TRACH_DISCON
Paux
ESO_DISCON
THERM_CURRENT
Heater_V
VREF
C19 0.1uF
C20 10uF
C21 0.1uF
R9 0
R6 1.62K,1%
VR1
APPROVED
QTY REQD PART OR IDENTIFYING NO. NOMENCLATURE OR DESCRIPTION MATERIAL SPECIFICATION FIND NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
APPROVALS DATE
DRAWN R.J. HALES 9.26.01
CHECKED MV NORTH 9.27.01
APPROVED S LANDAS 9.27.01
RELEASED J NELSON 9.28.01
VIASYS HEALTHCARE
CRITICAL CARE DIVISION
TITLE SCHEMATIC, EPM
SIZE C DWG NO. 51000-40332 REV A
SCALE: DO NOT SCALE DRAWING SHEET 1 OF 3
CRITICAL ☐ COMPONENT ☐ DEVICE ☒ N/A
TRACEABLE ☐ SERIAL NO. ☐ LOT NO. ☒ N/A


8.192V
C27 0.1uF
XDCR1 SCXL004DN
+VS
GND
R10 20.0K
R16 20.0K
C23 0.001uF,2%
C24 0.022uF
C28 0.001uF,2%
2.048V
+12V
C22 0.1uF
R11 1.62K,1%
U14 AD627BR
RG
REF
R12 2.2K,1%
-2.334 to +2.334 inches/H2O
0.0029cmH2O/count
VREF
D9 BAT54
C26 1uF
AWFLOW_PRESS
C25 0.1uF
U15A OP492GS
Q1 PMBT2N2907A
R41 10K
R14 392,1%
R13 2.21,1%
Q2 MJD127
R40 10K
R42 10K
R21 8.25k
R22 45.3K,1%
C29 100uf,16v
R24 1.0,1%
R18 1.62K,1%
R20 20.0K
U15B OP492GS
R23 2.2K,1%
D10 BAT54
THERM_CURRENT
R26 20.0K
R27 1.62K,1%
Healer_ctrl
R25 45.3K,1%
Q3 2N7002E
THERM+
R29 45.3K,1%
R31 2.2K,1%
Healer_V
R39H 10K
XDCR2 SCX05DN
R28 20.0K
R34 20.0K
C31 0.001uF,2%
C32 0.022uF
C34 0.1uF
C35 0.001uF,2%
C30 0.1uF
R30 1.96K,1%
U16 AD627BR
R32 2.2K,1%
-140 to +140
0.0068cmH2O/count
D11 BAT54
C33 1uF
ESO_PRESS
R39A 10K
R39B 10K
C36 0.1uF
U15C OP492GS
Q4 PMBT2N2222
XDCR3 SCX05DN
R35 20.0K
R38 20.0K
C37 0.001uF,2%
C39 0.022uF
C41 0.001uF,2%
R36 1.96K,1%
U17 AD627BR
C38 0.1uF
R37 2.2K,1%
D12 BAT54
C40 1uF
Paux
U15D OP492GS
R39C 10K
R39D 10K
SIZE C
DWG NO. 51000-40332
REV A
SCALE:
DO NOT SCALE DRAWING
SHEET 2 OF 3


8
7
6
5
4
3
2
1
D
C
B
A
VCC5
FAWAZ+
FAWAZ-
D13
DL4933
Q5
MTD3055VL
FAWPURGE+
FAWPURGE-
D14
DL4933
Q6
MTD3055VL
ESOFILL_SV+
ESOFILL_SV-
DL4933
D15
Q7
MTD3055VL
ESOEVAC_SV+
ESOEVAC_SV-
D16
DL4933
Q8
MTD3055VL
ESOISO_SV+
ESOISO_SV-
D17
DL4933
Q9
MTD3055VL
PauxPurge+
PauxPurge-
D18
DL4933
Q10
MTD3055VL
EPMSPARE_SV1+
EPMSPARE_SV1-
D19
DL4933
Q11
MTD3055VL
EPMSPARE_SV2+
EPMSPARE_SV2-
DL4933
D20
Q12
MTD3055VL
EPMSPARE_SV3+
EPMSPARE_SV3-
D21
DL4933
Q13
MTD3055VL
EPMSPARE_SV4+
EPMSPARE_SV4-
D22
DL4933
Q14
MTD3055VL
EPMSPARE_SV5+
EPMSPARE_SV5-
DL4933
D23
Q15
MTD3055VL
FAWAZ
FAWPURGE
ESOFILL_SV
ESOEVAC_SV
ESOISO_SV
PauxPURGE_SV
EPMSPARE_SV1
EPMSPARE_SV2
EPMSPARE_SV3
EPMSPARE_SV4
EPMSPARE_SV5
JP2
FAWAZ+
FAWAZ-
FAWPURGE+
FAWPURGE-
FAWPURGE+
FAWPURGE-
1 2 3 4 5 6 7 8
ESQ-108-24-G-S
JP3
ESOEVAC_SV+
ESOEVAC_SV-
ESOFILL_SV+
ESOFILL_SV-
ESOISO_SV+
ESOISO_SV-
1 2 3 4 5 6 7 8
ESQ-108-24-G-S
JP4
PauxPurge+
PauxPurge-
1 2 3 4 5 6 7 8
ESQ-108-24-G-S
J3
EPMSPARE_SV1+
EPMSPARE_SV1-
2
JP6
EPMSPARE_SV2+
EPMSPARE_SV2-
EPMSPARE_SV3+
EPMSPARE_SV3-
1 2 3 4
70545-0038
JP7
EPMSPARE_SV4+
EPMSPARE_SV4-
EPMSPARE_SV5+
EPMSPARE_SV5-
1 2 3 4
70545-0038
SIZE C
DWG NO. 51000-40332
REV A
SCALE:
DO NOT SCALE DRAWING
SHEET 3 OF 3

HL

Patient Assist Call


J2
PIN HEADER
3-POS, POL, LOCK
MTA-100
AMP 640456-4
70033
COM
N.C.
N.O.
1
2
3
CASE
E1
MTG HOLE
GROUND TO PANEL
L1
FERRITE BEAD
4-WIRE
MOD 8-DIP
68059
J1
MODULAR JACK
6 POSITION
6 CONTACT
CENTER LATCH
TOP ENTRY
AMP 520258-3
MOLEX 95022-2687
70246
V4
VARISTOR
820V NOM
510V RMS
680V DC
V10D821
68164
V3
VARISTOR
820V NOM
510V RMS
680V DC
V10D821
68164
V2
VARISTOR
820V NOM
510V RMS
680V DC
V10D821
68164
E2
MTG HOLE
GROUND TO PANEL
GROUND PLANE
A
B
C
D
1
2
3
4
5
6
7
8

REVISIONS

SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	PROD REL PER ECO# 53205	JKD	DD	8.24.95
B	REVISED PER ECO# 53681	JKD	DD	1-17-96

NOTES: UNLESS OTHERWISE SPECIFIED

1. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 50570.
2. J1 CONTACTS 3-4 NORMALLY OPEN, CLOSE ON ALARM, INOP, OR SHUTDOWN.
J1 CONTACTS 2-5 NORMALLY CLOSED, OPEN ON ALARM, INOP, OR SHUTDOWN.

CRITICAL ☐ COMPONENT ☐ DEVICE ☒ N/A
TRACEABLE ☐ SERIAL NO. ☐ LOT NO. ☒ N/A

ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.01 ANG ±1°00'
2. MACH SURFACES 63✓ OR BETTER
3. CORNER FILLETS & RADII .005/.010
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIM ARE IN INCHES

APPROVALS		DATE
DRAWN	J.K. DACK	8.22.95
CHECKED	L. BAKER	8.22.95
APPROVED	D.DeVRIES	8.22.95
RELEASED	T.PANGBORN	8.24.95

MAT'L

FINISH

BIRD

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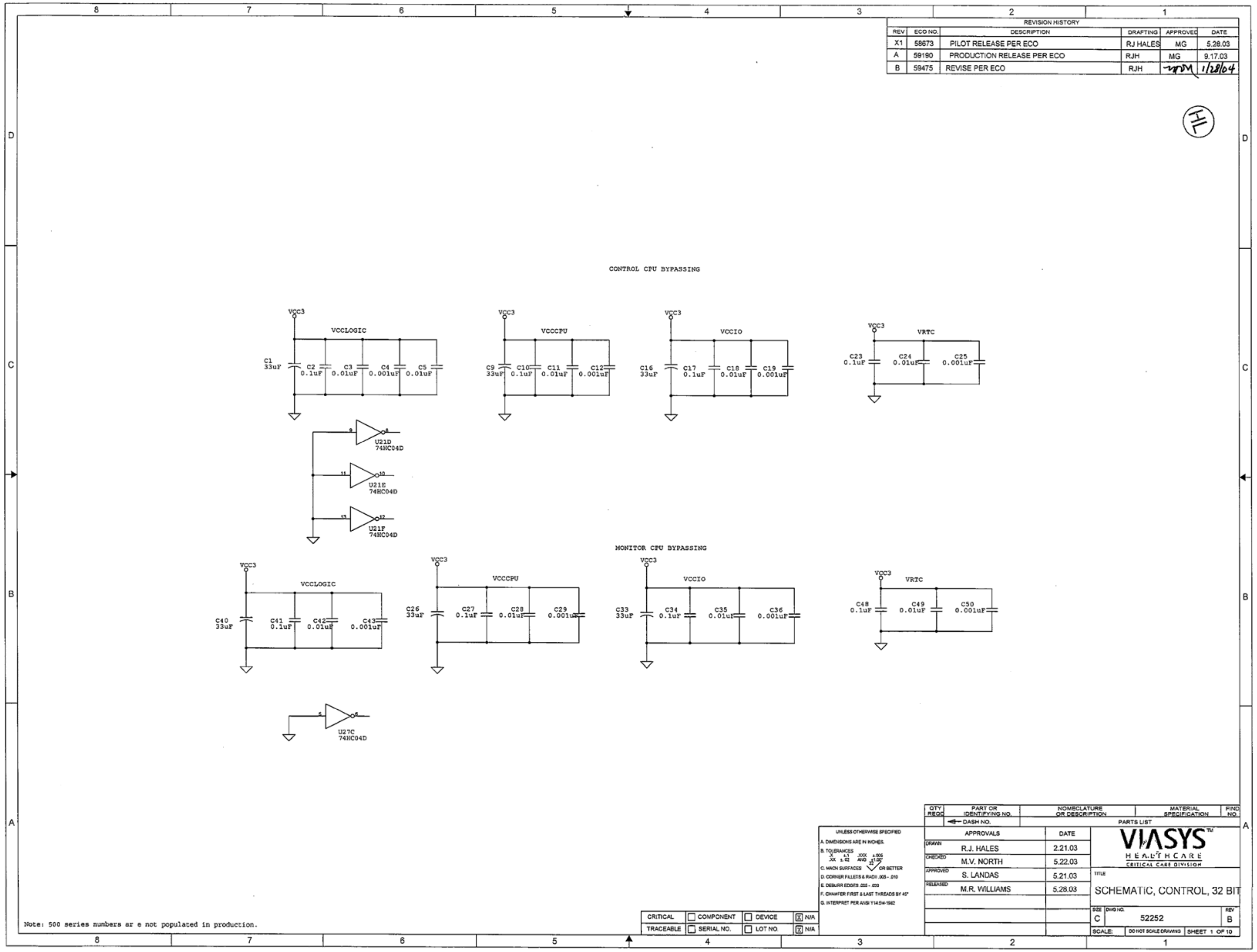
TITLE
SCHEMATIC,
PATIENT ASSIST CALL

D DWG NO. 50572 REV B

SCALE NONE DO NOT SCALE DRAWING SHEET 1 OF 1

Control, PCBA, 32 Bit


CONTROL CPU BYPASSING
VCC3
VCCLOGIC
C1
33uF
C2
0.1uF
C3
0.01uF
C4
0.001uF
C5
0.01uF
VCC3
VCCCPU
C9
33uF
C10
0.1uF
C11
0.01uF
C12
0.001uF
VCC3
VCCIO
C16
33uF
C17
0.1uF
C18
0.01uF
C19
0.001uF
VCC3
VRTC
C23
0.1uF
C24
0.01uF
C25
0.001uF
9
8
U21D
74HC04D
11
10
U21E
74HC04D
13
12
U21F
74HC04D
MONITOR CPU BYPASSING
VCC3
VCCLOGIC
C40
33uF
C41
0.1uF
C42
0.01uF
C43
0.001uF
VCC3
VCCCPU
C26
33uF
C27
0.1uF
C28
0.01uF
C29
0.001uF
VCC3
VCCIO
C33
33uF
C34
0.1uF
C35
0.01uF
C36
0.001uF
VCC3
VRTC
C48
0.1uF
C49
0.01uF
C50
0.001uF
5
6
U27C
74HC04D
8
7
6
5
4
3
2
1
D
C
B
A
HL

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	58673	PILOT RELEASE PER ECO	RJ HALES	MG	5.28.03
A	59190	PRODUCTION RELEASE PER ECO	RJH	MG	9.17.03
B	59475	REVISE PER ECO	RJH	MM	1/28/04

Note: 500 series numbers are not populated in production.

QTY REQD	PART OR IDENTIFYING NO.	NOMECLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◀ DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XX ±.02 .XXX ±.005 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	R.J. HALES	2.21.03
CHECKED	M.V. NORTH	5.22.03
APPROVED	S. LANDAS	5.21.03
RELEASED	M.R. WILLIAMS	5.28.03

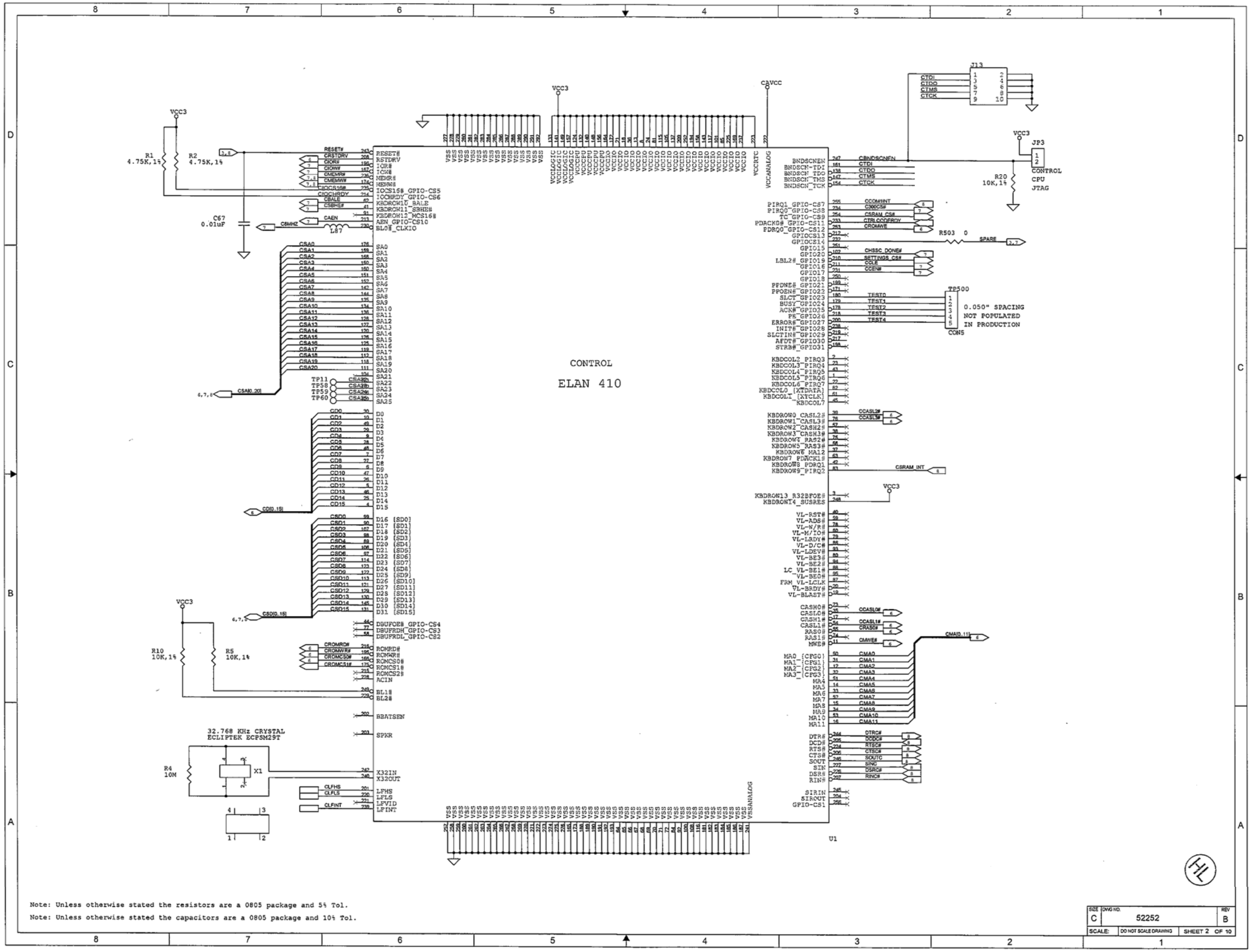
CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION

TITLE SCHEMATIC, CONTROL, 32 BIT

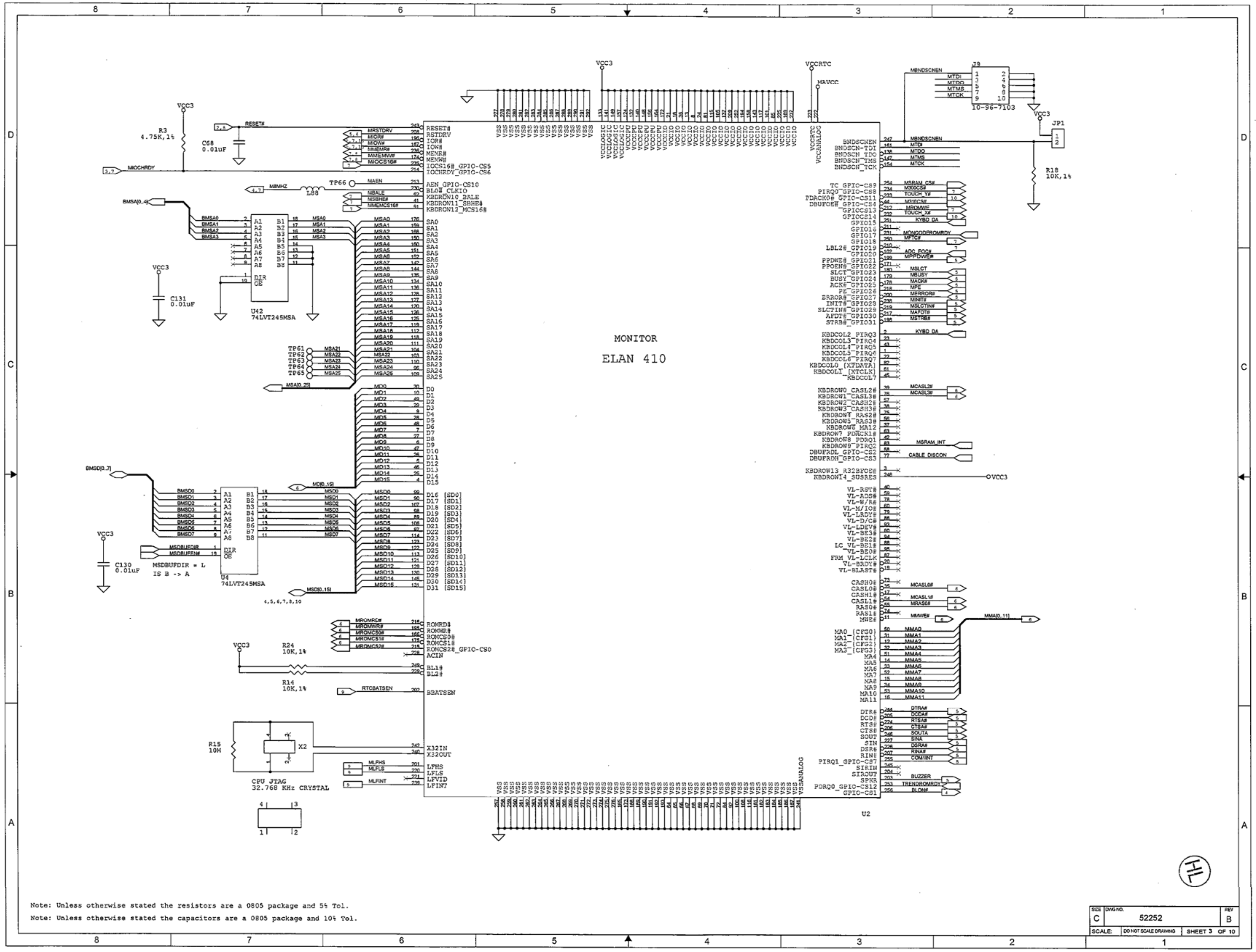
SIZE C DWG NO. 52252 REV B

SCALE: DO NOT SCALE DRAWING SHEET 1 OF 10


CONTROL
ELAN 410
U1
VCC3
CAVCC
J13
JP3
CONTROL
CPU
JTAG
R20
10K,1%
R503 0
SPARE
TP500
0.050" SPACING
NOT POPULATED
IN PRODUCTION
CON5
R1
4.75K,1%
R2
4.75K,1%
C67
0.01uF
L87
R10
10K,1%
R5
10K,1%
32.768 KHz CRYSTAL
ECLIPTEK ECPSM29T
R4
10M
X1
TP11
TP58
TP59
TP60
SIZE C
DWG NO. 52252
REV B
SCALE:
DO NOT SCALE DRAWING
SHEET 2 OF 10

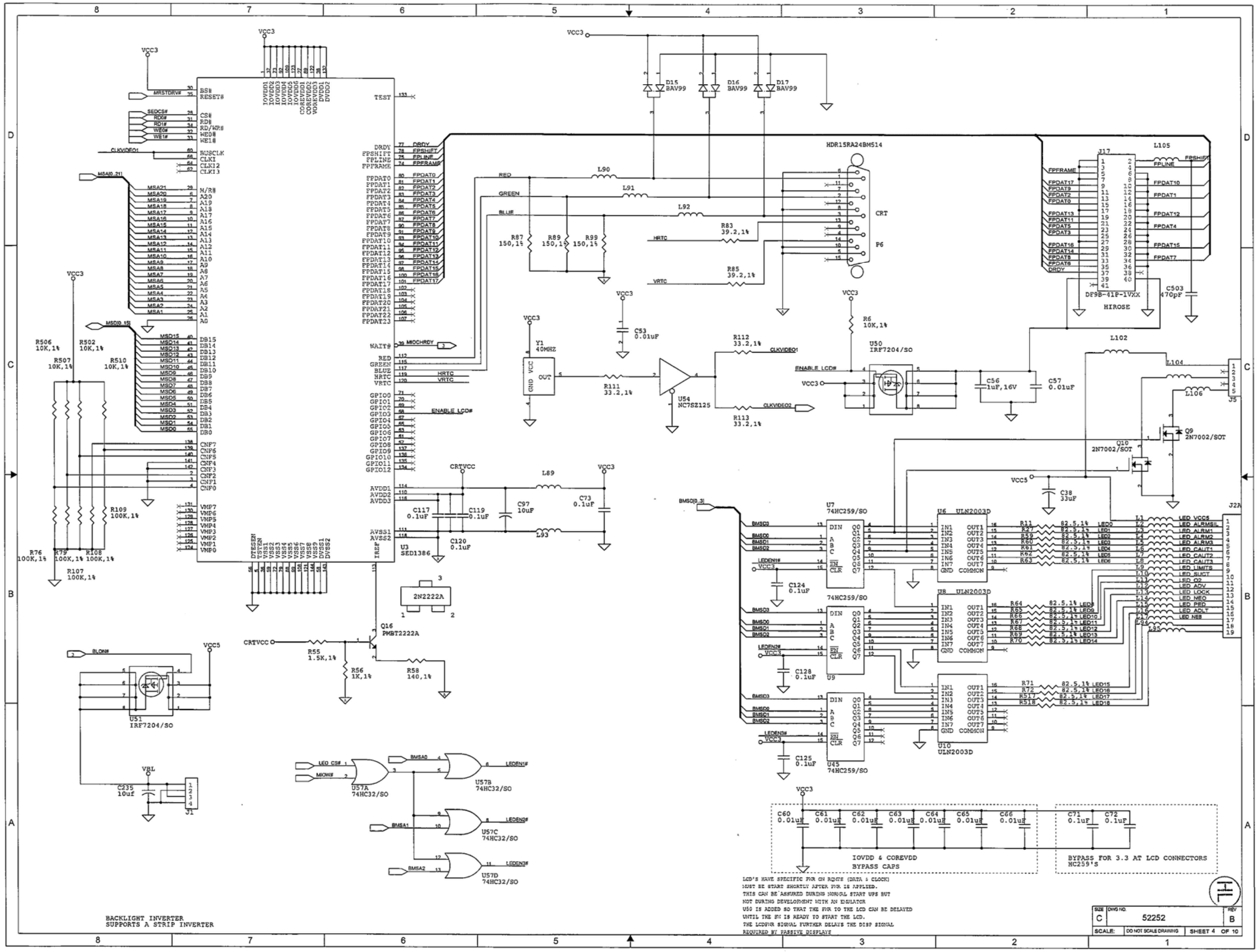
Note: Unless otherwise stated the resistors are a 0805 package and 5% Tol.

Note: Unless otherwise stated the capacitors are a 0805 package and 10% Tol.


MONITOR
ELAN 410
U2
U42
74LVT245MSA
U4
74LVT245MSA
MSDBUFDIR = L
IS B -> A
VCC3
VCCRTC
MAVCC
R3
4.75K,1%
C68
0.01uF
C131
0.01uF
C130
0.01uF
R24
10K,1%
R14
10K,1%
R15
10M
R18
10K,1%
X2
CPU JTAG
32.768 KHz CRYSTAL
J9
10-96-7103
JP1
L88
TP66
TP61
TP62
TP63
TP64
TP65
SIZE C
DWG NO. 52252
REV B
SCALE: DO NOT SCALE DRAWING
SHEET 3 OF 10

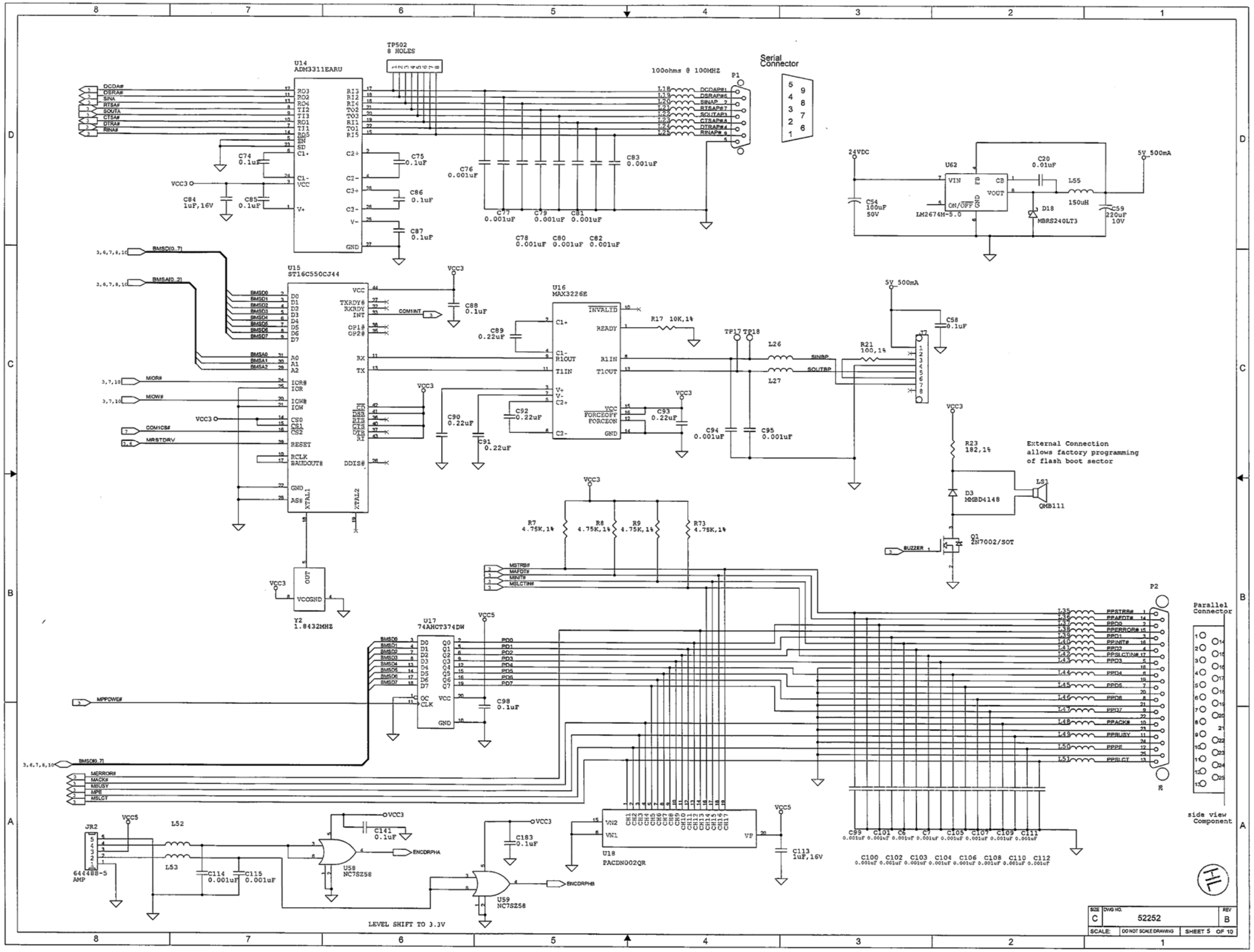
Note: Unless otherwise stated the resistors are a 0805 package and 5% Tol.

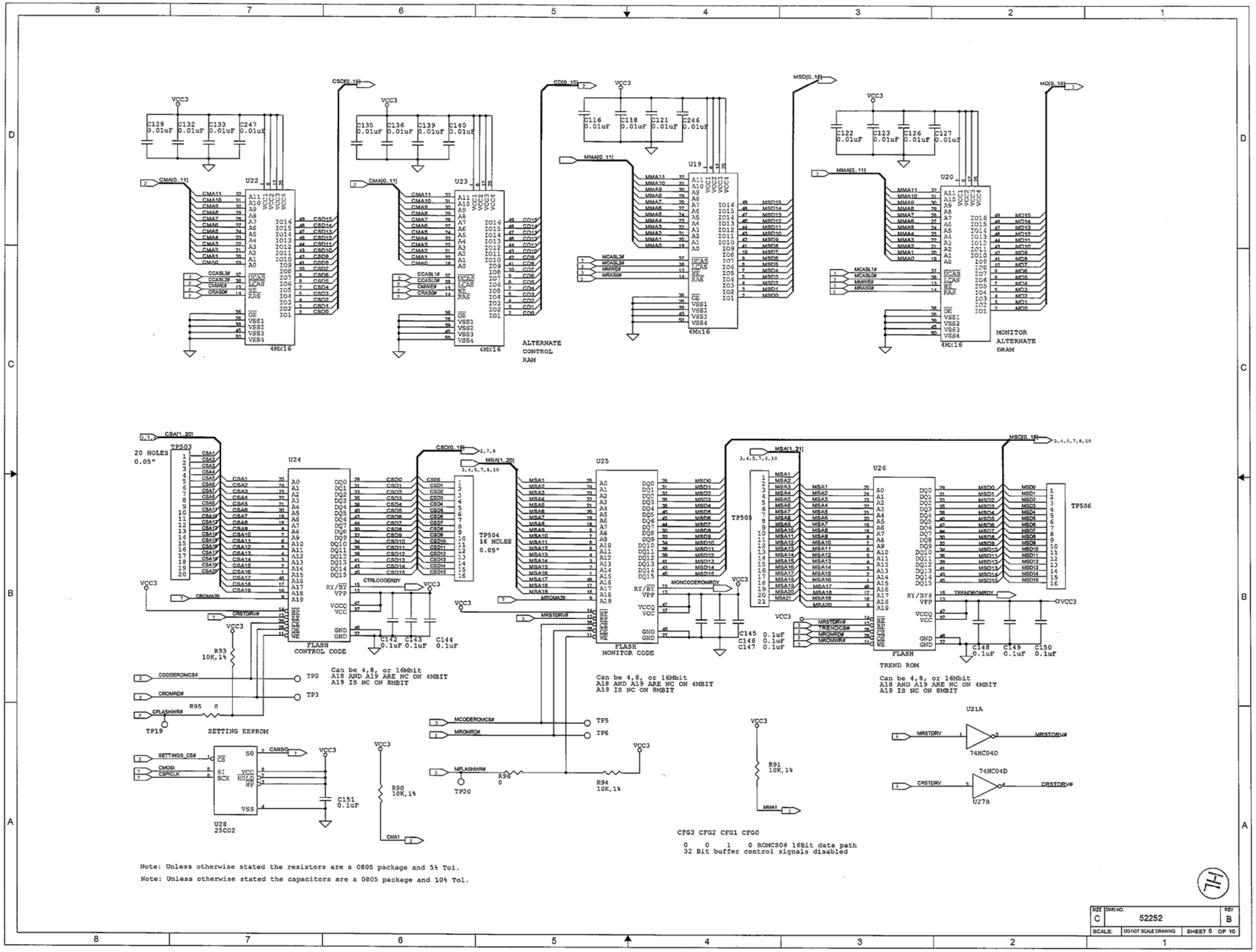
Note: Unless otherwise stated the capacitors are a 0805 package and 10% Tol.


U3
SED1386
HDR15RA24BM514
CRT
P6
J17
DF9B-41P-1VXX
HIROSE
L105
C503
470pF
D15
BAV99
D16
BAV99
D17
BAV99
L90
L91
L92
R87
150,1%
R89
150,1%
R98
150,1%
R83
39.2,1%
R85
39.2,1%
HRTC
VRTC
RED
GREEN
BLUE
Y1
40MHZ
C53
0.01uF
R111
33.2,1%
U54
NC7SZ125
R112
33.2,1%
R113
33.2,1%
CLKVIDEO1
CLKVIDEO2
R6
10K,1%
U50
IRF7204/SO
ENABLE LCD#
C56
1uF,16V
C57
0.01uF
L102
L104
L106
J5
Q9
2N7002/SOT
Q10
2N7002/SOT
VCC5
C38
33uF
CRTVCC
L89
L93
C117
0.1uF
C119
0.1uF
C120
0.1uF
C97
10uF
C73
0.1uF
R506
10K,1%
R502
10K,1%
R507
10K,1%
R510
10K,1%
R109
100K,1%
R76
100K,1%
R79
100K,1%
R108
100K,1%
R107
100K,1%
2N2222A
Q16
PMBT2222A
R55
1.5K,1%
R56
1K,1%
R58
140,1%
BLON#
U51
IRF7204/SO
VBL
C235
10uf
J1
U57A
74HC32/SO
U57B
74HC32/SO
U57C
74HC32/SO
U57D
74HC32/SO
LED CS#
MIOW#
LEDEN1#
LEDEN2#
LEDEN3#
BMSA0
BMSA1
BMSA2
U7
74HC259/SO
U9
74HC259/SO
U45
74HC259/SO
U6
ULN2003D
U8
ULN2003D
U10
ULN2003D
C124
0.1uF
C128
0.1uF
C125
0.1uF
J2A
LED VCC5
LED ALRMSIL
LED ALRM1
LED ALRM2
LED ALRM3
LED CAUT1
LED CAUT2
LED CAUT3
LED LIMITS
LED SUCT
LED O2
LED ADV
LED LOCK
LED NEO
LED PED
LED ADLT
LED NEB
C60
0.01uF
C61
0.01uF
C62
0.01uF
C63
0.01uF
C64
0.01uF
C65
0.01uF
C66
0.01uF
C71
0.1uF
C72
0.1uF
IOVDD & COREVDD
BYPASS CAPS
BYPASS FOR 3.3 AT LCD CONNECTORS
HC259'S
VCC3
BACKLIGHT INVERTER
SUPPORTS A STRIP INVERTER

LCD'S HAVE SPECIFIC PWR ON RQMTS (DATA & CLOCK)
MUST BE START SHORTLY AFTER PWR IS APPLIED.
THIS CAN BE ASSURED DURING NORMAL START UPS BUT
NOT DURING DEVELOPMENT WITH AN EMULATOR
U50 IS ADDED SO THAT THE PWR TO THE LCD CAN BE DELAYED
UNTIL THE SW IS READY TO START THE LCD.
THE LCDPWR SIGNAL FURTHER DELAYS THE DISP SIGNAL
REQUIRED BY PASSIVE DISPLAYS

SIZE	DWG NO.	REV
C	52252	B
SCALE:	DO NOT SCALE DRAWING	SHEET 4 OF 10


TP502
8 HOLES
U14
ADM3311EARU
100ohms @ 100MHZ
P1
Serial Connector
C74 0.1uF
C75 0.1uF
C84 1uF,16V
C85 0.1uF
C86 0.1uF
C87 0.1uF
C76 0.001uF
C83 0.001uF
C77 0.001uF
C79 0.001uF
C81 0.001uF
C78 0.001uF
C80 0.001uF
C82 0.001uF
VCC3
24VDC
U62
LM2674M-5.0
C20 0.01uF
L55 150uH
D18 MBRS240LT3
C54 100uF 50V
C59 220uF 10V
5V_500mA
U15
ST16C550CJ44
BMSD[0..7]
BMSA[0..2]
MIOR#
MIOW#
COM1CS#
MRSTDRV
COMINT
C88 0.1uF
U16
MAX3226E
C89 0.22uF
C90 0.22uF
C91 0.22uF
C92 0.22uF
C93 0.22uF
R17 10K,1%
TP17 TP18
L26
L27
R21 100,1%
C58 0.1uF
J7
SINBP
SOUTBP
C94 0.001uF
C95 0.001uF
R23 182,1%
External Connection allows factory programming of flash boot sector
D3 MMBD4148
LS1 QMB111
Q1 2N7002/SOT
BUZZER
Y2 1.8432MHZ
R7 4.75K,1%
R8 4.75K,1%
R9 4.75K,1%
R73 4.75K,1%
MSTRB#
MAFDT#
MINIT#
MSLCTIN#
P2
Parallel Connector
U17
74AHCT374DW
VCC5
C98 0.1uF
MPPOWE#
MERROR#
MACK#
MBUSY
MPE
MSLCT
L35–L51
PPSTRB#
PPAFDT#
PPD0
PPERROR#
PPD1
PPINIT#
PPD2
PPSLCTIN#
PPD3
PPD4
PPD5
PPD6
PPD7
PPACK#
PPBUSY
PPPE
PPSLCT
side view Component
JR2
640488-5 AMP
L52
L53
C114 0.001uF
C115 0.001uF
C141 0.1uF
U58 NC7SZ58
U59 NC7SZ58
ENCDRPHA
ENCDRPHB
C183 0.1uF
U18 PACDN002QR
C113 1uF,16V
C99 C101 C6 C7 C105 C107 C109 C111
C100 C102 C103 C104 C106 C108 C110 C112
LEVEL SHIFT TO 3.3V
SIZE C
DWG NO. 52252
REV B
SCALE: DO NOT SCALE DRAWING
SHEET 5 OF 10


U22
4Mx16
U23
4Mx16
ALTERNATE
CONTROL
RAM
U19
4Mx16
U20
4Mx16
MONITOR
ALTERNATE
DRAM
VCC3
CMA[0..11]
CSD[0..15]
CD[0..15]
MMA[0..11]
MSD[0..15]
MD[0..15]
TP503
20 HOLES
0.05"
U24
FLASH
CONTROL CODE
TP504
16 HOLES
0.05"
U25
FLASH
MONITOR CODE
TP505
U26
FLASH
TREND ROM
TP506
CSA[1..20]
MSA[1..21]
CTRLCODERDY
MONCODEROMRDY
TRENDROMRDY
Can be 4,8, or 16Mbit
A18 AND A19 ARE NC ON 4MBIT
A19 IS NC ON 8MBIT
C142 0.1uF
C143 0.1uF
C144 0.1uF
C145 0.1uF
C146 0.1uF
C147 0.1uF
C148 0.1uF
C149 0.1uF
C150 0.1uF
R93 10K,1%
R95 0
TP2
TP3
TP19
SETTING EEPROM
CCODEROMCS#
CROMRD#
CFLASHWR#
SETTINGS_CS#
CMOSI
CSPICLK
CMISO
U28
25C02
C151 0.1uF
R90 10K,1%
CMA1
MCODEROMCS#
MROMRD#
MFLASHWR#
TP5
TP6
TP20
R96 0
R94 10K,1%
R91 10K,1%
MMA1
U21A
74HC04D
MRSTDRV
MRSTDRV#
CRSTDRV
CRSTDRV#
U27B

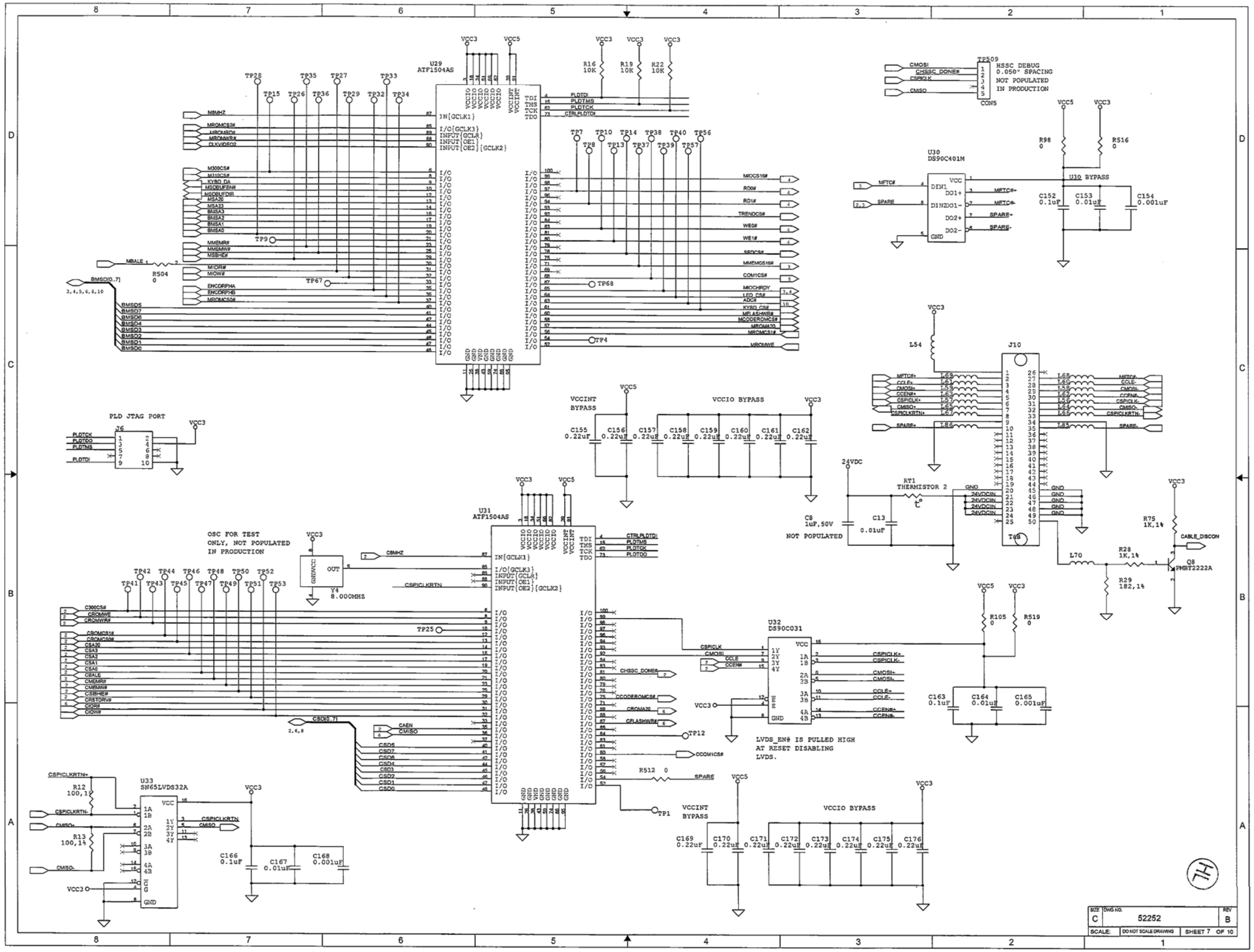
CFG3 CFG2 CFG1 CFG0

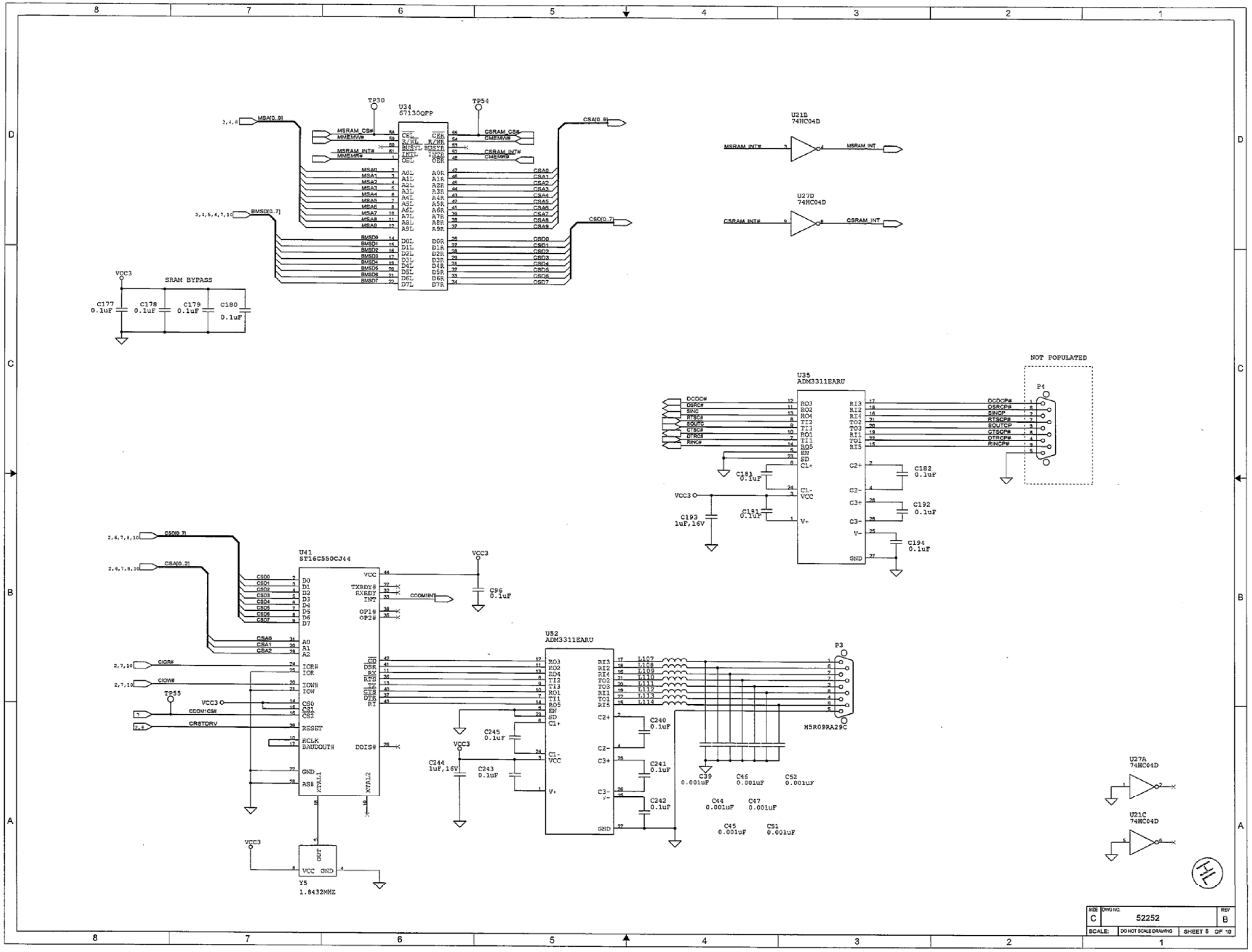
0 0 1 0 ROMCS0# 16Bit data path
32 Bit buffer control signals disabled

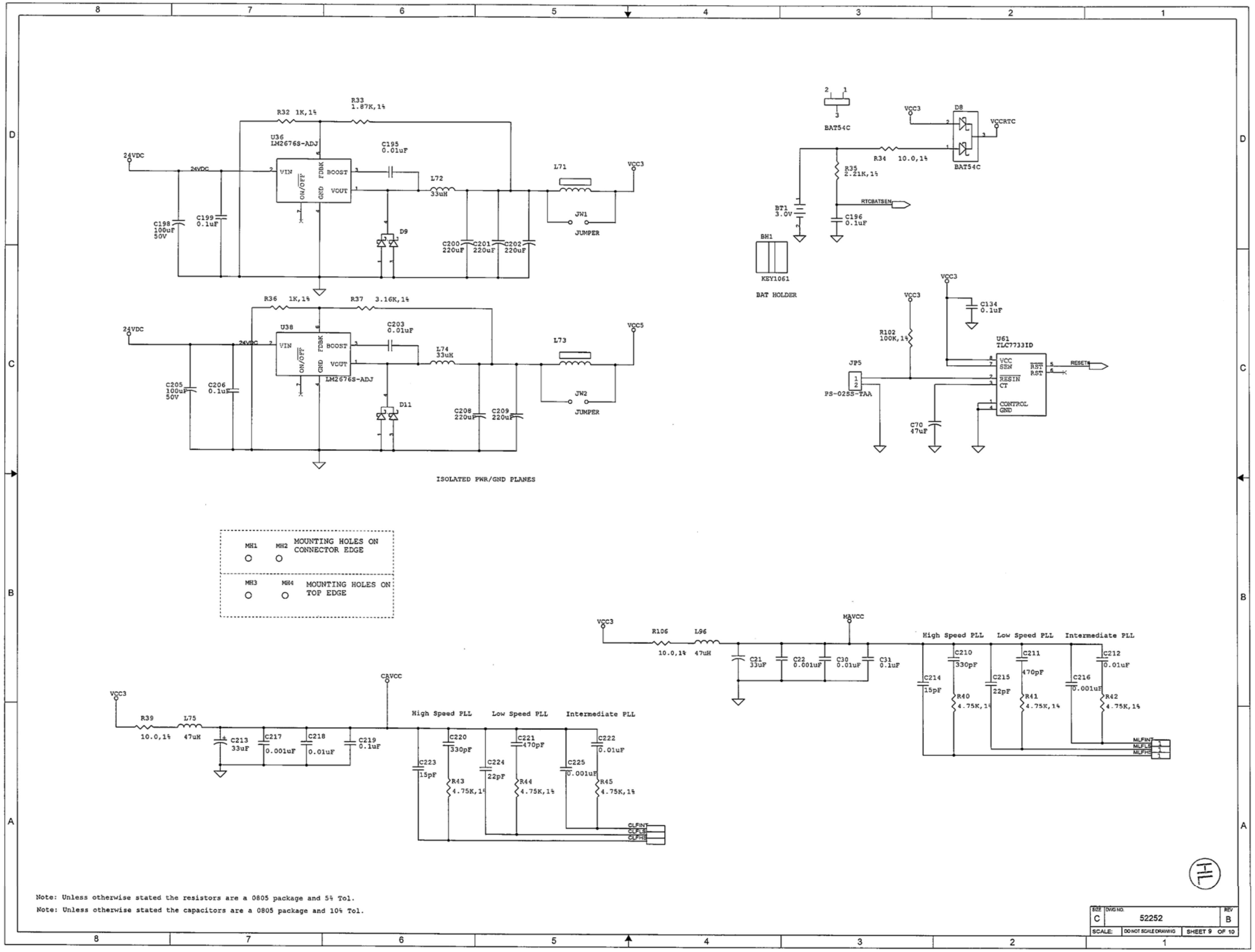
Note: Unless otherwise stated the resistors are a 0805 package and 5% Tol.

Note: Unless otherwise stated the capacitors are a 0805 package and 10% Tol.

SIZE	DWG NO.	REV
C	52252	B
SCALE:	DO NOT SCALE DRAWING	SHEET 6 OF 10

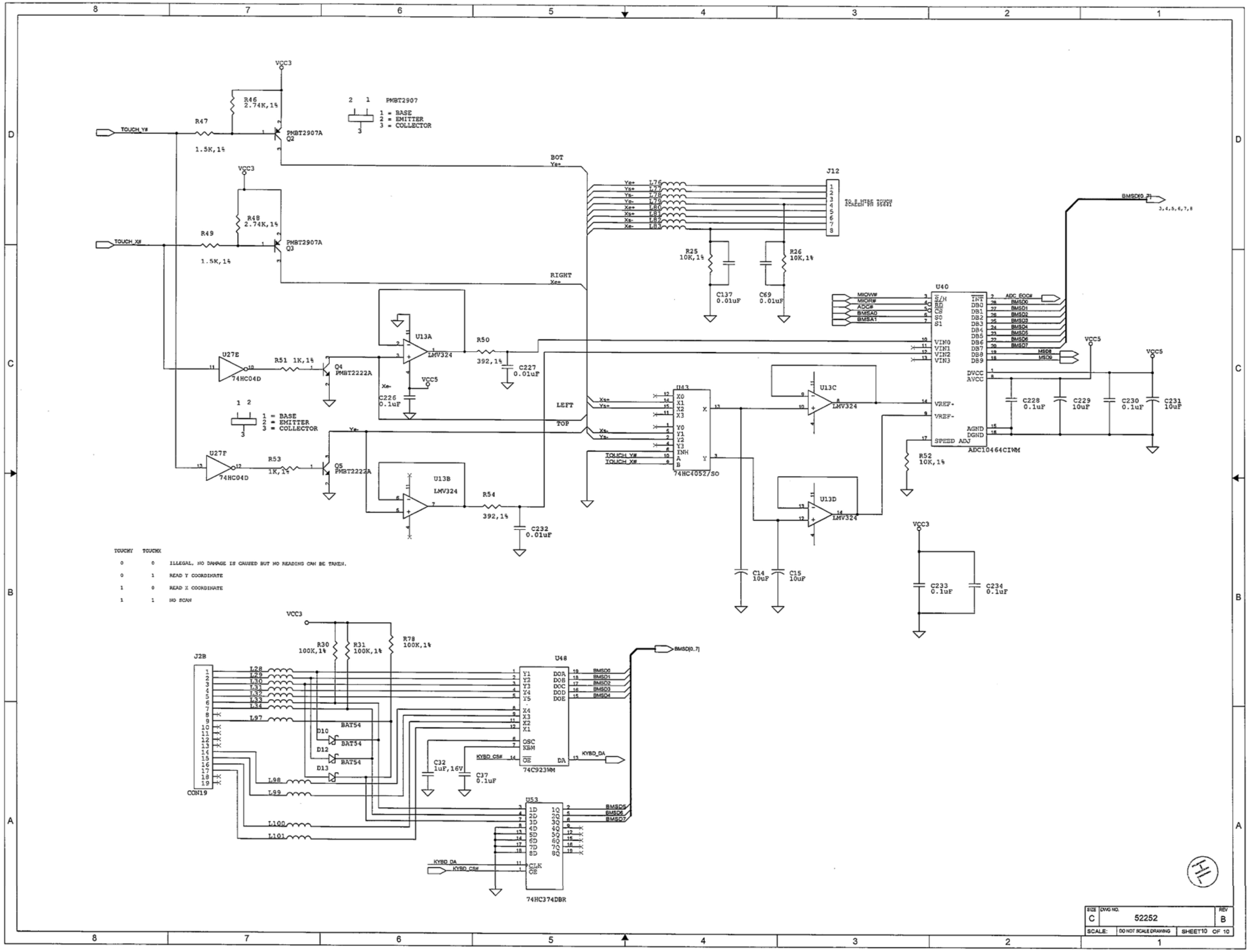

U29
ATF1504AS
U31
ATF1504AS
U30
DS90C401M
U32
DS90C031
U33
SN65LVDS32A
J10
J6
PLD JTAG PORT
TP509
HSSC DEBUG
0.050" SPACING
NOT POPULATED
IN PRODUCTION
CON5
OSC FOR TEST
ONLY, NOT POPULATED
IN PRODUCTION
Y4
8.000MHZ
VCCINT
BYPASS
VCCIO BYPASS
U30 BYPASS
RT1
THERMISTOR 2
C8
1uF,50V
NOT POPULATED
Q8
PMBT2222A
LVDS_EN# IS PULLED HIGH
AT RESET DISABLING
LVDS.
VCC3
VCC5
24VDC
SIZE C
DWG NO. 52252
REV B
SCALE:
DO NOT SCALE DRAWING
SHEET 7 OF 10


8
7
6
5
4
3
2
1
D
C
B
A
TP30
U34
67130QFP
TP54
3,4,6
MSA[0..9]
CSA[0..9]
MSRAM_CS#
MMEMW#
MSRAM_INT#
MMEMR#
CEL
R/WL
BUSYL
INTL
OEL
CER
R/WR
BUSYR
INTR
OER
CSRAM_CS#
CMEMW#
CSRAM_INT#
CMEMR#
MSA0
MSA1
MSA2
MSA3
MSA4
MSA5
MSA6
MSA7
MSA8
MSA9
A0L
A1L
A2L
A3L
A4L
A5L
A6L
A7L
A8L
A9L
A0R
A1R
A2R
A3R
A4R
A5R
A6R
A7R
A8R
A9R
CSA0
CSA1
CSA2
CSA3
CSA4
CSA5
CSA6
CSA7
CSA8
CSA9
3,4,5,6,7,10
BMSD[0..7]
CSD[0..7]
BMSD0
BMSD1
BMSD2
BMSD3
BMSD4
BMSD5
BMSD6
BMSD7
D0L
D1L
D2L
D3L
D4L
D5L
D6L
D7L
D0R
D1R
D2R
D3R
D4R
D5R
D6R
D7R
CSD0
CSD1
CSD2
CSD3
CSD4
CSD5
CSD6
CSD7
VCC3
SRAM BYPASS
C177
0.1uF
C178
0.1uF
C179
0.1uF
C180
0.1uF
U21B
74HC04D
MSRAM_INT#
MSRAM_INT
U27D
74HC04D
CSRAM_INT#
CSRAM_INT
NOT POPULATED
U35
ADM3311EARU
P4
DCDC#
DSRC#
SINC
RTSC#
SOUTC
CTSC#
DTRC#
RINC#
RO3
RO2
RO4
TI2
TI3
RO1
TI1
RO5
EN
SD
C1+
C1-
VCC
V+
RI3
RI2
RI4
TO2
TO3
RI1
TO1
RI5
C2+
C2-
C3+
C3-
V-
GND
DCDCP#
DSRCP#
SINCP
RTSCP#
SOUTCP
CTSCP#
DTRCP#
RINCP#
C181
0.1uF
VCC3
C193
1uF,16V
C191
0.1uF
C182
0.1uF
C192
0.1uF
C194
0.1uF
2,6,7,8,10
CSD[0..7]
2,6,7,8,10
CSA[0..2]
U41
ST16C550CJ44
CSD0
CSD1
CSD2
CSD3
CSD4
CSD5
CSD6
CSD7
D0
D1
D2
D3
D4
D5
D6
D7
CSA0
CSA1
CSA2
A0
A1
A2
2,7,10
CIOR#
IOR#
IOR
2,7,10
CIOW#
IOW#
IOW
TP55
VCC3
CCOM1CS#
7
CS0
CS1
CS2
2,6
CRSTDRV
RESET
RCLK
BAUDOUT#
GND
AS#
XTAL1
XTAL2
VCC
TXRDY#
RXRDY
INT
CCOM1INT
OP1#
OP2#
CD
DSR
RX
RTS
TX
CTS
DTR
RI
DDIS#
VCC3
C96
0.1uF
VCC3
OUT
VCC
GND
Y5
1.8432MHZ
U52
ADM3311EARU
C245
0.1uF
VCC3
C244
1uF,16V
C243
0.1uF
L107
L108
L109
L110
L111
L112
L113
L114
C240
0.1uF
C241
0.1uF
C242
0.1uF
P3
H5R09RA29C
C39
0.001uF
C46
0.001uF
C52
0.001uF
C44
0.001uF
C47
0.001uF
C45
0.001uF
C51
0.001uF
U27A
74HC04D
U21C
74HC04D
HL
SIZE
C
DWG NO.
52252
REV
B
SCALE:
DO NOT SCALE DRAWING
SHEET 8 OF 10


8
7
6
5
4
3
2
1
D
C
B
A
R32 1K,1%
R33
1.87K,1%
U36
LM2676S-ADJ
C195
0.01uF
24VDC
24VDC
VIN
ON/OFF
FDBK
GND
BOOST
VOUT
L72
33uH
L71
VCC3
JW1
JUMPER
C198
100uF
50V
C199
0.1uF
D9
C200
220uF
C201
220uF
C202
220uF
R36 1K,1%
R37 3.16K,1%
U38
C203
0.01uF
24VDC
24VDC
L74
33uH
L73
VCC5
LM2676S-ADJ
C205
100uF
50V
C206
0.1uF
D11
C208
220uF
C209
220uF
JW2
JUMPER
ISOLATED PWR/GND PLANES
MH1
MH2
MOUNTING HOLES ON
CONNECTOR EDGE
MH3
MH4
MOUNTING HOLES ON
TOP EDGE
2 1
3
BAT54C
VCC3
D8
VCCRTC
R34 10.0,1%
BAT54C
R35
2.21K,1%
BT1
3.0V
RTCBATSEN
C196
0.1uF
BH1
KEY1061
BAT HOLDER
VCC3
C134
0.1uF
VCC3
R102
100K,1%
U61
TLC7733ID
VCC
SEN
RESIN
CT
CONTROL
GND
RST
RST
RESET*
JP5
PS-02SS-TAA
C70
47uF
VCC3
R106
10.0,1%
L96
47uH
MAVCC
C21
33uF
C22
0.001uF
C30
0.01uF
C31
0.1uF
High Speed PLL
Low Speed PLL
Intermediate PLL
C210
330pF
C211
470pF
C212
0.01uF
C214
15pF
C215
22pF
C216
0.001uF
R40
4.75K,1%
R41
4.75K,1%
R42
4.75K,1%
MLFINT
MLFLS
MLFHS
VCC3
R39
10.0,1%
L75
47uH
CAVCC
C213
33uF
C217
0.001uF
C218
0.01uF
C219
0.1uF
High Speed PLL
Low Speed PLL
Intermediate PLL
C220
330pF
C221
470pF
C222
0.01uF
C223
15pF
C224
22pF
C225
0.001uF
R43
4.75K,1%
R44
4.75K,1%
R45
4.75K,1%
CLFINT
CLFLS
CLFHS
HL

Note: Unless otherwise stated the resistors are a 0805 package and 5% Tol.
Note: Unless otherwise stated the capacitors are a 0805 package and 10% Tol.

SIZE C
DWG NO. 52252
REV B
SCALE:
DO NOT SCALE DRAWING
SHEET 9 OF 10

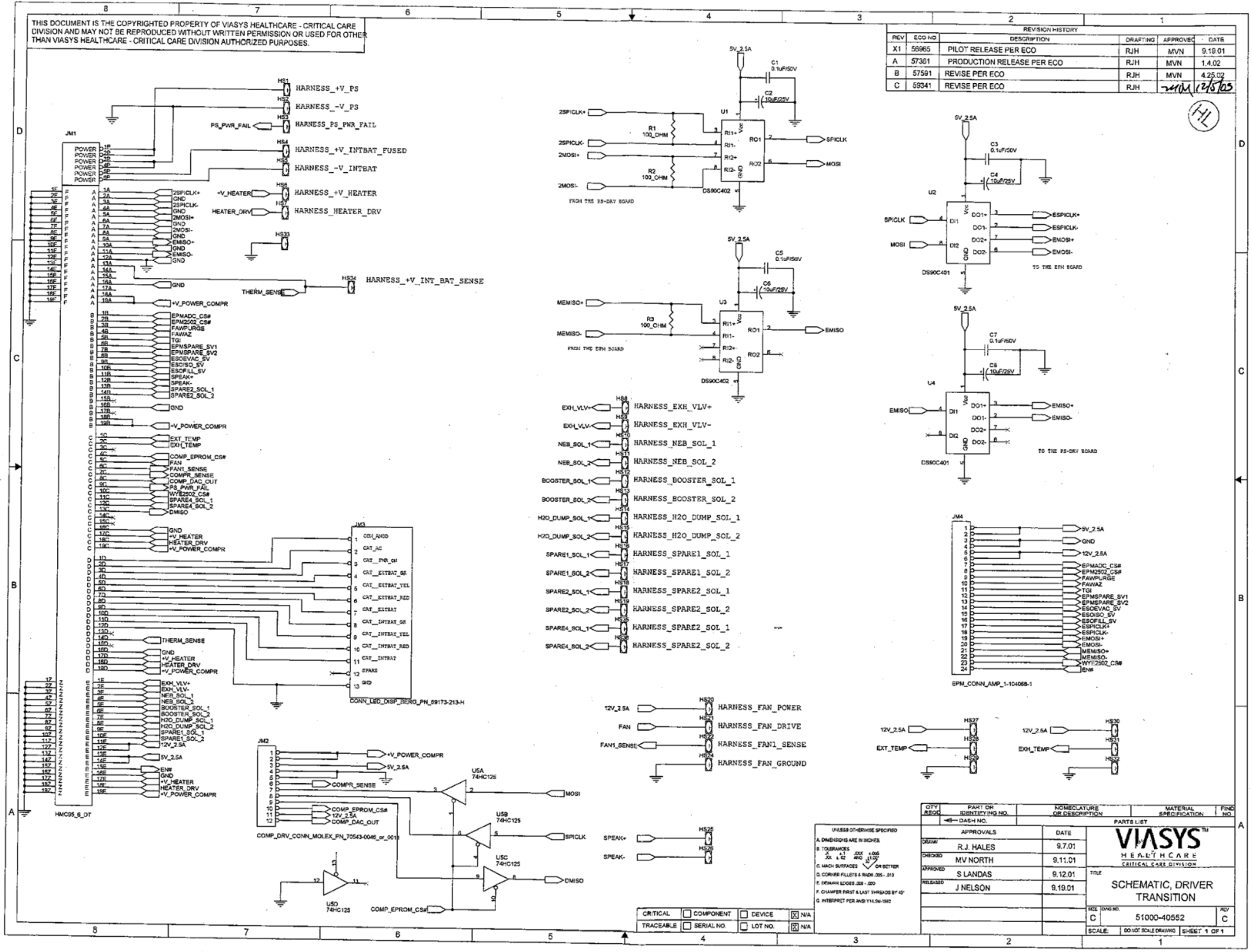

VCC3
R46 2.74K,1%
R47 1.5K,1%
TOUCH_Y#
PMBT2907A Q2
PMBT2907
1 = BASE
2 = EMITTER
3 = COLLECTOR
BOT Ye+
R48 2.74K,1%
R49 1.5K,1%
TOUCH_X#
PMBT2907A Q3
RIGHT Xe+
J12
L76 L77 L78 L79 L80 L81 L82 L83
Ye+ Ye+ Ye- Ye- Xe+ Xe+ Xe- Xe-
R25 10K,1%
R26 10K,1%
C137 0.01uF
C69 0.01uF
BMSD[0..7]
3,4,5,6,7,8
U40
MIOW# MIOR# ADC# BMSA0 BMSA1
S/H RD CS S0 S1
INT DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 DB8 DB9
ADC_EOC#
BMSD0 BMSD1 BMSD2 BMSD3 BMSD4 BMSD5 BMSD6 BMSD7 MSD8 MSD9
VIN0 VIN1 VIN2 VIN3
DVCC AVCC
VREF- VREF-
AGND DGND
SPEED ADJ
ADC10464CIWM
VCC5
C228 0.1uF
C229 10uF
C230 0.1uF
C231 10uF
U13A LMV324
R50 392,1%
C227 0.01uF
U27E 74HC04D
R51 1K,1%
Q4 PMBT2222A
Xe-
C226 0.1uF
VCC5
LEFT
TOP
U43
X0 X1 X2 X3 Y0 Y1 Y2 Y3 INH A B
X Y
74HC4052/SO
U13C LMV324
R52 10K,1%
U27F 74HC04D
R53 1K,1%
Q5 PMBT2222A
Ye-
U13B LMV324
R54 392,1%
C232 0.01uF
U13D LMV324
C14 10uF
C15 10uF
VCC3
C233 0.1uF
C234 0.1uF
J2B
CON19
R30 100K,1%
R31 100K,1%
R78 100K,1%
L28 L29 L30 L31 L32 L33 L34 L97
D10 BAT54
D12 BAT54
D13 BAT54
L98 L99 L100 L101
U48
Y1 Y2 Y3 Y4 Y5 X4 X3 X2 X1
OSC KBM OE
DOA DOB DOC DOD DOE DA
KYBD_CS#
KYBD_DA
C32 1uF,16V
C37 0.1uF
74C923WM
U53
1D 2D 3D 4D 5D 6D 7D 8D CLK OE
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
74HC374DBR
8 7 6 5 4 3 2 1
D C B A

TOUCHY	TOUCHX	
0	0	ILLEGAL, NO DAMAGE IS CAUSED BUT NO READING CAN BE TAKEN.
0	1	READ Y COORDINATE
1	0	READ X COORDINATE
1	1	NO SCAN

SIZE	DWG NO.	REV
C	52252	B
SCALE:	DO NOT SCALE DRAWING	SHEET10 OF 10

HL

PCBA, Driver Transition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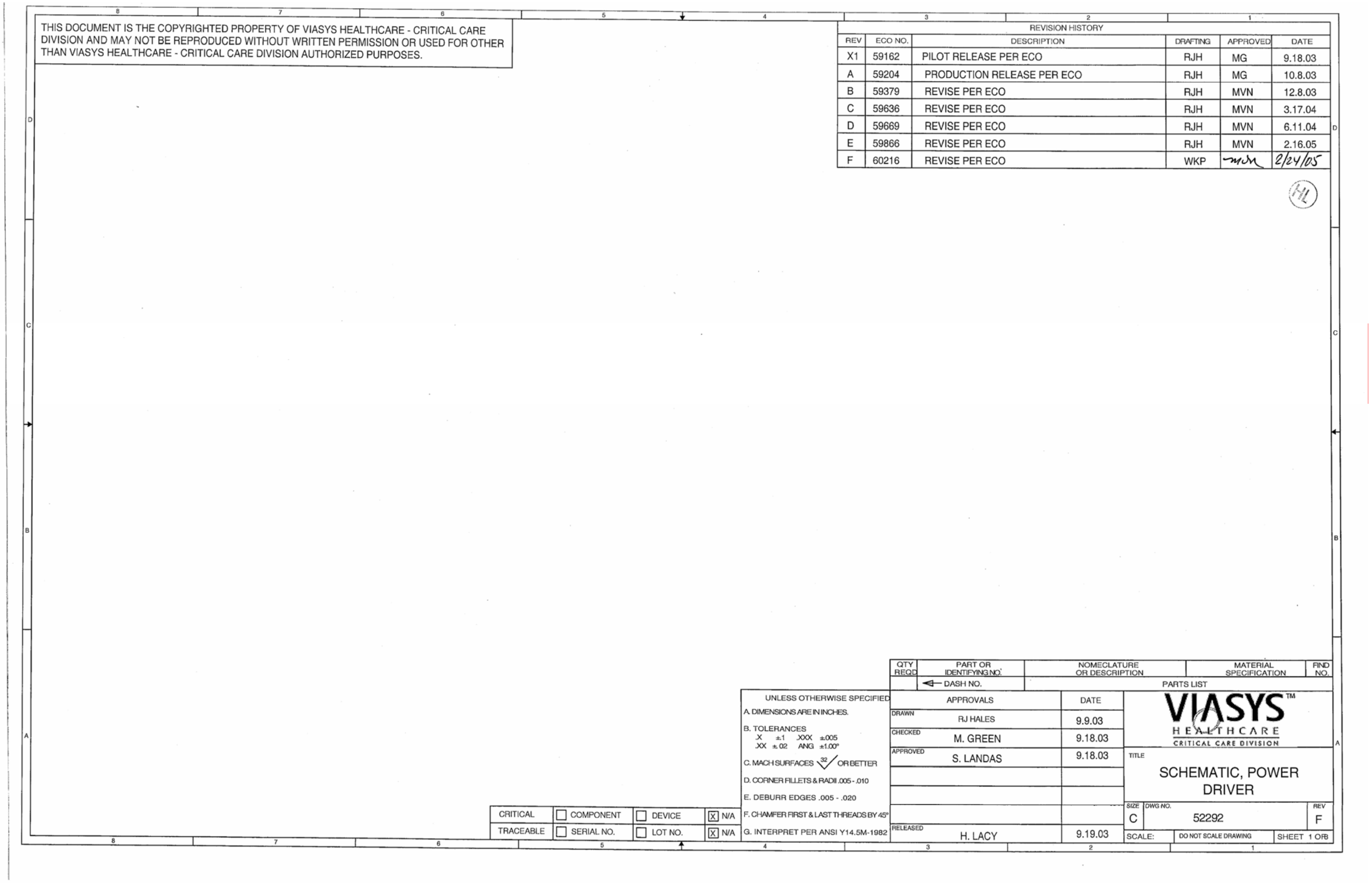
REVISION HISTORY
REV | ECO NO | DESCRIPTION | DRAFTING | APPROVED | DATE
X1 | 56965 | PILOT RELEASE PER ECO | RJH | MVN | 9.19.01
A | 57361 | PRODUCTION RELEASE PER ECO | RJH | MVN | 1.4.02
B | 57591 | REVISE PER ECO | RJH | MVN | 4.25.02
C | 59341 | REVISE PER ECO | RJH | MVN | 12/5/03
HL
JM1
HS1 HARNESS_+V_PS
HS2 HARNESS_-V_PS
HS3 HARNESS_PS_PWR_FAIL
PS_PWR_FAIL
HS4 HARNESS_+V_INTBAT_FUSED
HS5 HARNESS_-V_INTBAT
HS6 HARNESS_+V_HEATER
+V_HEATER
HS7 HARNESS_HEATER_DRV
HEATER_DRV
HS33
HS34 HARNESS_+V_INT_BAT_SENSE
THERM_SENSE
POWER
2SPICLK+
GND
2SPICLK-
2MOSI+
2MOSI-
EMISO+
EMISO-
+V_POWER_COMPR
EPMADC_CS#
EPM2502_CS#
FAWPURGE
FAWAZ
TGI
EPMSPARE_SV1
EPMSPARE_SV2
ESOEVAC_SV
ESOISO_SV
ESOFILL_SV
SPEAK+
SPEAK-
SPARE2_SOL_1
SPARE2_SOL_2
EXT_TEMP
EXH_TEMP
COMP_EPROM_CS#
FAN
FAN1_SENSE
COMPR_SENSE
COMP_DAC_OUT
PS_PWR_FAIL
WYE2502_CS#
SPARE4_SOL_1
SPARE4_SOL_2
DMISO
EXH_VLV+
EXH_VLV-
NEB_SOL_1
NEB_SOL_2
BOOSTER_SOL_1
BOOSTER_SOL_2
H2O_DUMP_SOL_1
H2O_DUMP_SOL_2
SPARE1_SOL_1
SPARE1_SOL_2
12V_2.5A
5V_2.5A
EN#
HMC95_6_DT
JM3
CAT_AHGD
CAT_AC
CAT_PWR_ON
CAT_EXTBAT_GR
CAT_EXTBAT_YEL
CAT_EXTBAT_RED
CAT_EXTBAT
CAT_INTBAT_GR
CAT_INTBAT_YEL
CAT_INTBAT_RED
CAT_INTBAT
SPARE
GND
CONN_LED_DISP_BERG_PN_69173-213-H
JM2
COMP_DRV_CONN_MOLEX_PN_70543-0046_or_0013
U5A 74HC125
U5B 74HC125
U5C 74HC125
U5D 74HC125
MOSI
SPICLK
DMISO
COMP_EPROM_CS#
5V_2.5A
C1 0.1uF/50V
C2 10uF/25V
U1
R1 100_OHM
R2 100_OHM
DS90C402
RI1+
RI1-
RI2+
RI2-
RO1
RO2
Vcc
GND
SPICLK
MOSI
FROM THE PS-DRV BOARD
C3 0.1uF/50V
C4 10uF/25V
U2
DS90C401
DI1
DI2
DO1+
DO1-
DO2+
DO2-
ESPICLK+
ESPICLK-
EMOSI+
EMOSI-
TO THE ETH BOARD
C5 0.1uF/50V
C6 10uF/25V
U3
R3 100_OHM
MEMISO+
MEMISO-
EMISO
FROM THE ETH BOARD
C7 0.1uF/50V
C8 10uF/25V
U4
EMISO+
EMISO-
TO THE PS-DRV BOARD
HS8 HARNESS_EXH_VLV+
HS9 HARNESS_EXH_VLV-
HS10 HARNESS_NEB_SOL_1
HS11 HARNESS_NEB_SOL_2
HS12 HARNESS_BOOSTER_SOL_1
HS13 HARNESS_BOOSTER_SOL_2
HS14 HARNESS_H2O_DUMP_SOL_1
HS15 HARNESS_H2O_DUMP_SOL_2
HS16 HARNESS_SPARE1_SOL_1
HS17 HARNESS_SPARE1_SOL_2
HS18 HARNESS_SPARE2_SOL_1
HS19 HARNESS_SPARE2_SOL_2
HARNESS_SPARE2_SOL_1
HARNESS_SPARE2_SOL_2
SPARE4_SOL_1
SPARE4_SOL_2
JM4
EPM_CONN_AMP_1-104068-1
WYE2502_CS#
EN#
HS20 HARNESS_FAN_POWER
HS21 HARNESS_FAN_DRIVE
HS22 HARNESS_FAN1_SENSE
HS24 HARNESS_FAN_GROUND
FAN1_SENSE
HS25
HS26
SPEAK+
SPEAK-
HS27
HS28
HS29
EXT_TEMP
HS30
HS31
HS32
EXH_TEMP
CRITICAL ☐ COMPONENT ☐ DEVICE ☒ N/A
TRACEABLE ☐ SERIAL NO. ☐ LOT NO. ☒ N/A
UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES
B. TOLERANCES .X ±.1 .XX ±.02 .XXX ±.005 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982
QTY REQD
PART OR IDENTIFYING NO.
NOMECLATURE OR DESCRIPTION
MATERIAL SPECIFICATION
FIND NO.
DASH NO.
PARTS LIST
APPROVALS
DATE
DRAWN R.J. HALES 9.7.01
CHECKED MV NORTH 9.11.01
APPROVED S LANDAS 9.12.01
RELEASED J NELSON 9.19.01
VIASYS™ HEALTHCARE CRITICAL CARE DIVISION
TITLE SCHEMATIC, DRIVER TRANSITION
SIZE C
DWG NO. 51000-40552
REV C
SCALE: DO NOT SCALE DRAWING
SHEET 1 OF 1
8 7 6 5 4 3 2 1
D C B A

PCBA, Power Driver Board



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REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	59162	PILOT RELEASE PER ECO	RJH	MG	9.18.03
A	59204	PRODUCTION RELEASE PER ECO	RJH	MG	10.8.03
B	59379	REVISE PER ECO	RJH	MVN	12.8.03
C	59636	REVISE PER ECO	RJH	MVN	3.17.04
D	59669	REVISE PER ECO	RJH	MVN	6.11.04
E	59866	REVISE PER ECO	RJH	MVN	2.16.05
F	60216	REVISE PER ECO	WKP		2/24/05

HL

QTY REQD	PART OR IDENTIFYING NO.	NOMECLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◄— DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED

A. DIMENSIONS ARE IN INCHES.

B. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.02 ANG ±1.00°

C. MACH SURFACES 32✓ OR BETTER

D. CORNER FILLETS & RADII .005 - .010

E. DEBURR EDGES .005 - .020

F. CHAMFER FIRST & LAST THREADS BY 45°

G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	RJ HALES	9.9.03
CHECKED	M. GREEN	9.18.03
APPROVED	S. LANDAS	9.18.03
RELEASED	H. LACY	9.19.03

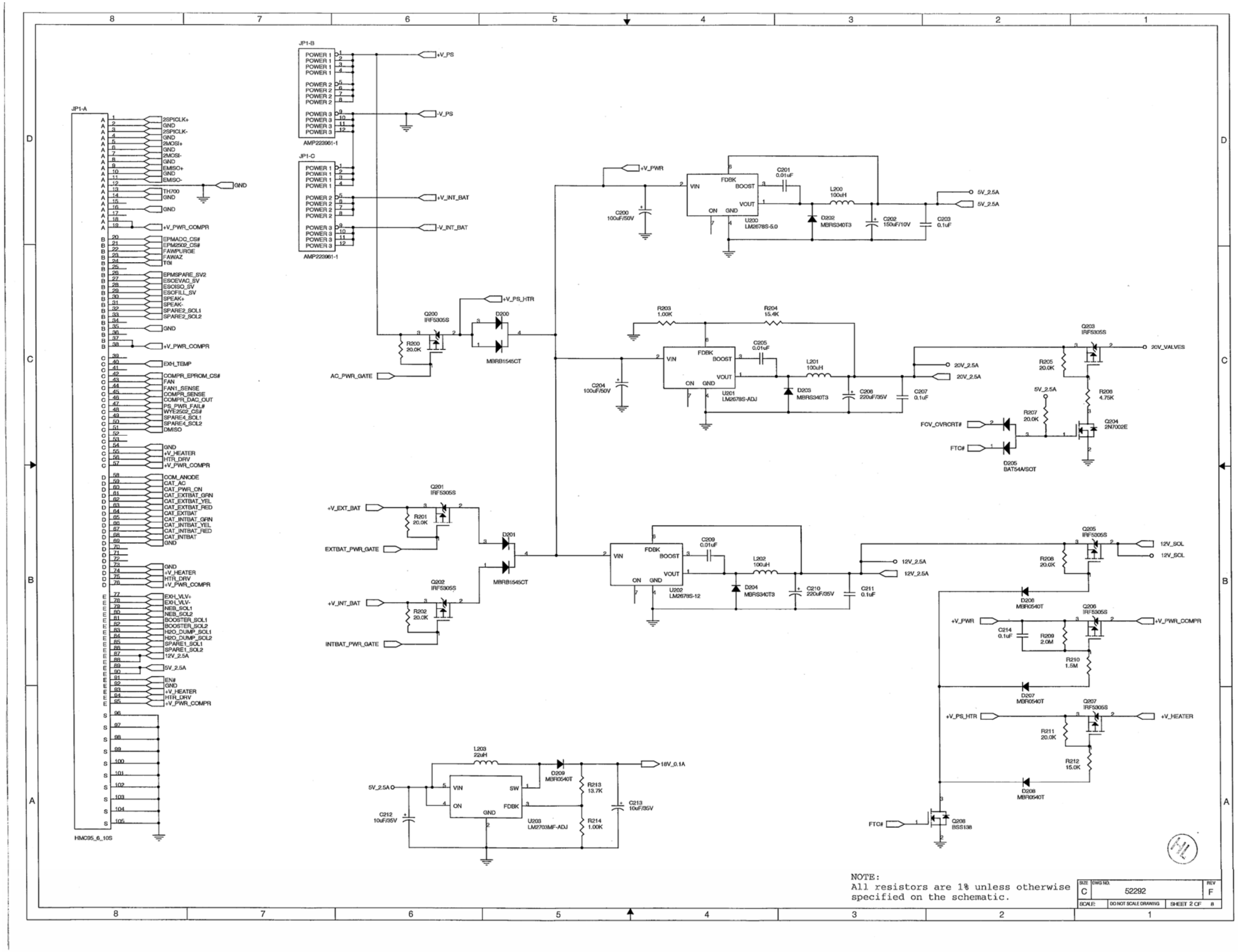
CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

VIASYS™
HEALTHCARE
CRITICAL CARE DIVISION

TITLE
SCHEMATIC, POWER DRIVER

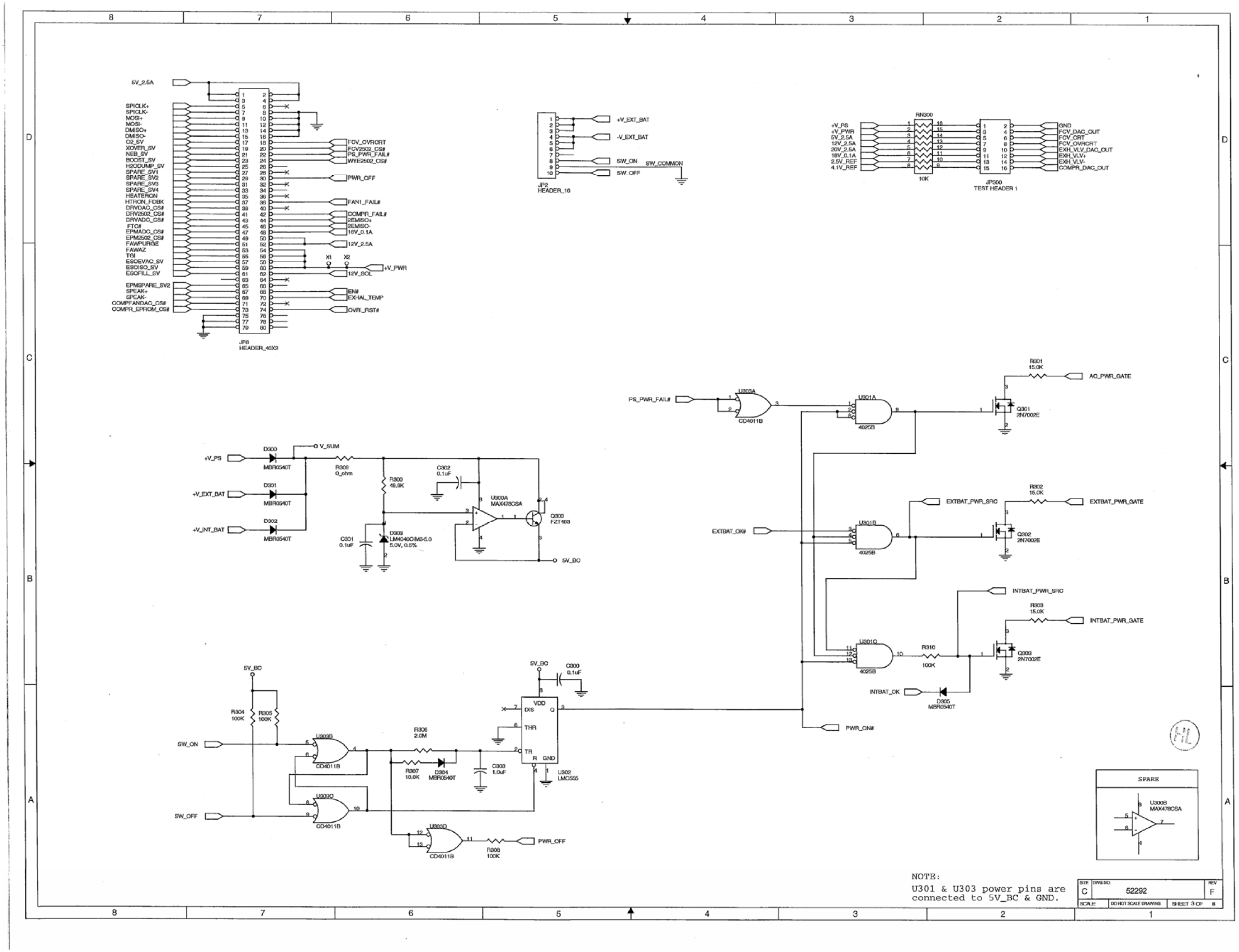
SIZE	DWG NO.	REV
C	52292	F

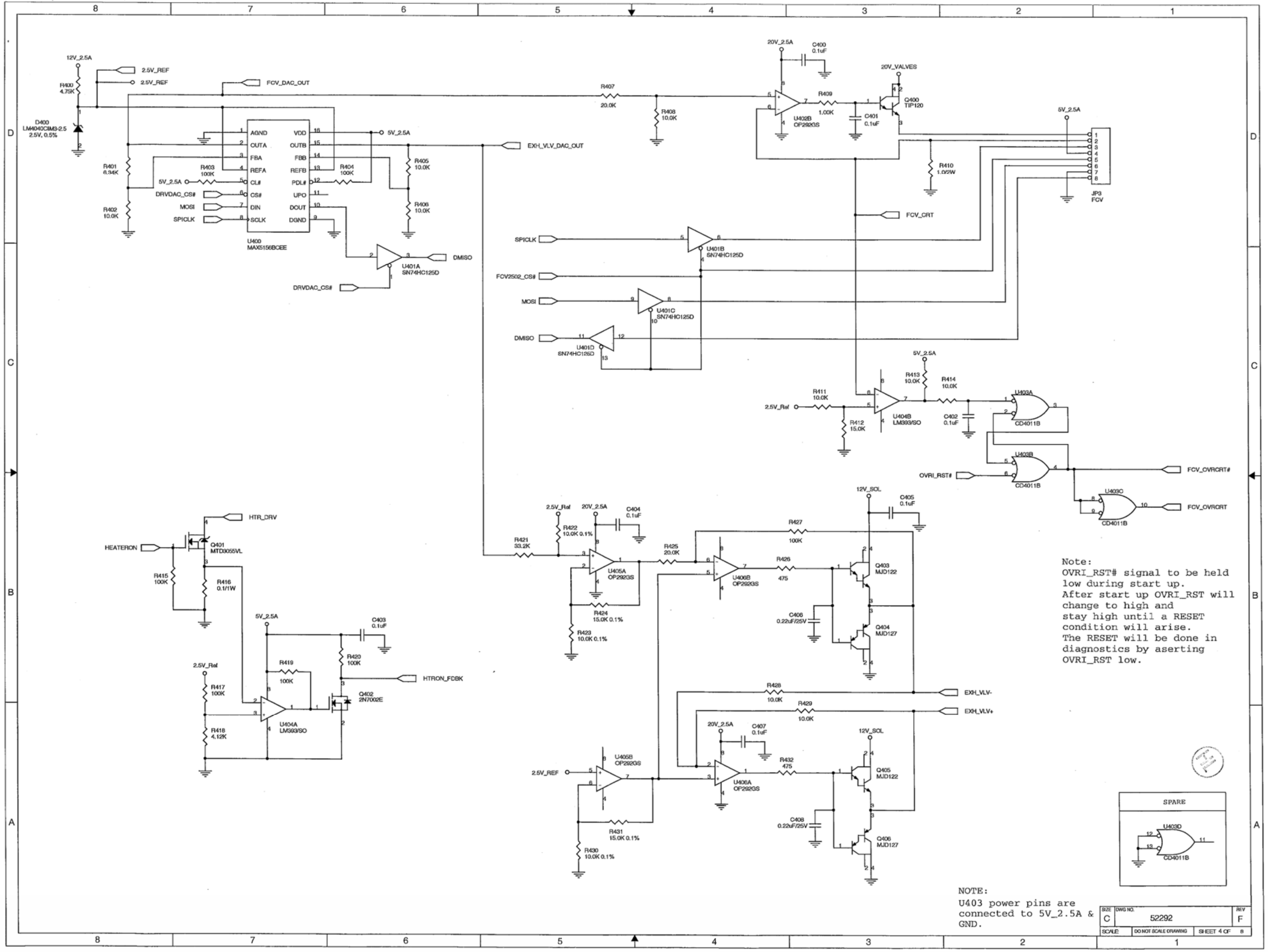
SCALE: DO NOT SCALE DRAWING SHEET 1 OF 8


JP1-A
JP1-B
JP1-C
POWER 1
POWER 2
POWER 3
AMP223961-1
+V_PS
-V_PS
+V_INT_BAT
-V_INT_BAT
+V_PWR
+V_PS_HTR
Q200 IRF5305S
D200
MBRB1545CT
R200 20.0K
AC_PWR_GATE
+V_EXT_BAT
Q201 IRF5305S
R201 20.0K
EXTBAT_PWR_GATE
D201
MBRB1545CT
+V_INT_BAT
Q202 IRF5305S
R202 20.0K
INTBAT_PWR_GATE
U200 LM2678S-5.0
C200 100uF/50V
C201 0.01uF
L200 100uH
D202 MBRS340T3
C202 150uF/10V
C203 0.1uF
5V_2.5A
R203 1.00K
R204 15.4K
U201 LM2678S-ADJ
C204 100uF/50V
C205 0.01uF
L201 100uH
D203 MBRS340T3
C206 220uF/35V
C207 0.1uF
20V_2.5A
Q203 IRF5305S
R205 20.0K
R206 4.75K
R207 20.0K
Q204 2N7002E
20V_VALVES
FCV_OVRCRT#
FTC#
D205 BAT54A/SOT
U202 LM2678S-12
C209 0.01uF
L202 100uH
D204 MBRS340T3
C210 220uF/35V
C211 0.1uF
12V_2.5A
Q205 IRF5305S
R208 20.0K
12V_SOL
D206 MBR0540T
Q206 IRF5305S
C214 0.1uF
R209 2.0M
R210 1.5M
+V_PWR_COMPR
D207 MBR0540T
Q207 IRF5305S
R211 20.0K
R212 15.0K
+V_HEATER
D208 MBR0540T
Q208 BSS138
L203 22uH
D209 MBR0540T
18V_0.1A
U203 LM2703MF-ADJ
C212 10uF/35V
R213 13.7K
R214 1.00K
C213 10uF/35V
HMC95_6_105
GND
VIN
FDBK
BOOST
VOUT
ON
SW
8
7
6
5
4
3
2
1
D
C
B
A

NOTE:
All resistors are 1% unless otherwise specified on the schematic.

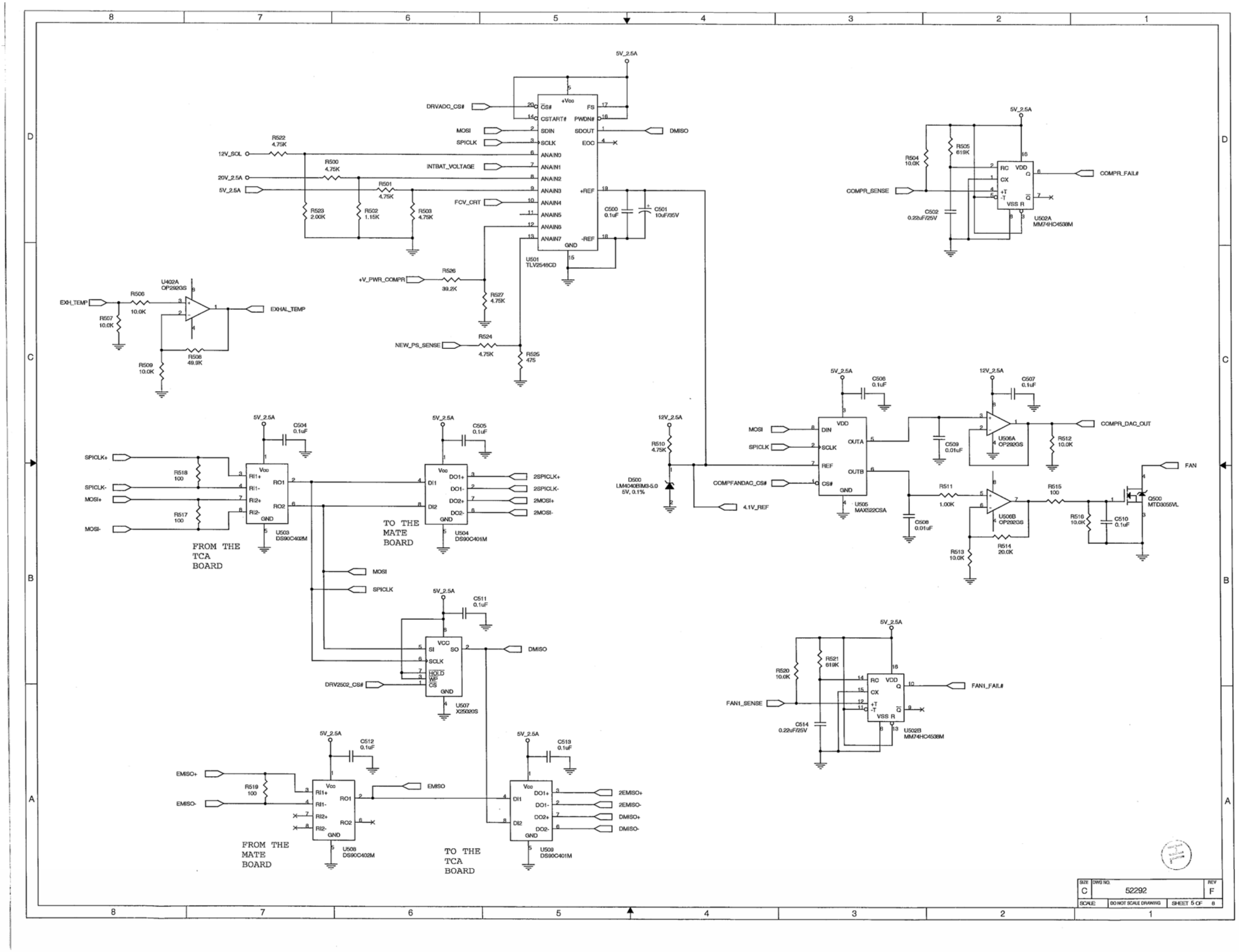
SIZE	DWG NO.	REV
C	52292	F
SCALE	DO NOT SCALE DRAWING	SHEET 2 OF 8

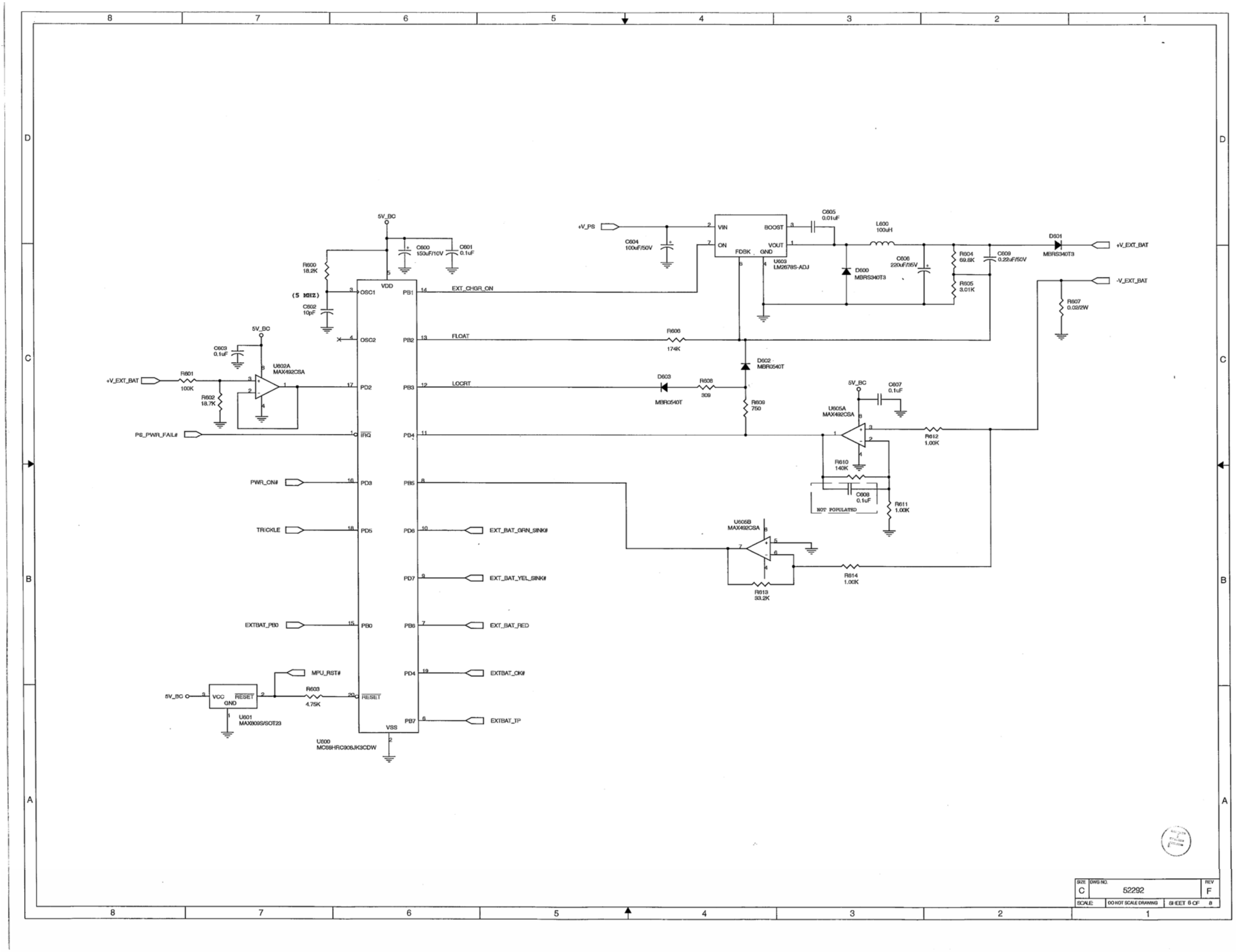

5V_2.5A
SPICLK+
SPICLK-
MOSI+
MOSI-
DMISO+
DMISO-
O2_SV
XOVER_SV
NEB_SV
BOOST_SV
H2ODUMP_SV
SPARE_SV1
SPARE_SV2
SPARE_SV3
SPARE_SV4
HEATERON
HTRON_FDBK
DRVDAC_CS#
DRV2502_CS#
DRVADC_CS#
FTC#
EPMADC_CS#
EPM2502_CS#
FAWPURGE
FAWAZ
TGI
ESOEVAC_SV
ESOISO_SV
ESOFILL_SV
EPMSPARE_SV2
SPEAK+
SPEAK-
COMPFANDAC_CS#
COMPR_EPROM_CS#
FCV_OVRCRT
FCV2502_CS#
PS_PWR_FAIL#
WYE2502_CS#
PWR_OFF
FAN1_FAIL#
COMPR_FAIL#
2EMISO+
2EMISO-
18V_0.1A
12V_2.5A
X1
X2
+V_PWR
12V_SOL
EN#
EXHAL_TEMP
OVRI_RST#
JP8
HEADER_40X2
+V_EXT_BAT
-V_EXT_BAT
SW_ON
SW_OFF
SW_COMMON
JP2
HEADER_10
RN300
10K
+V_PS
+V_PWR
5V_2.5A
12V_2.5A
20V_2.5A
18V_0.1A
2.5V_REF
4.1V_REF
GND
FCV_DAC_OUT
FCV_CRT
FCV_OVRCRT
EXH_VLV_DAC_OUT
EXH_VLV+
EXH_VLV-
COMPR_DAC_OUT
JP300
TEST HEADER 1
R301
15.0K
AC_PWR_GATE
PS_PWR_FAIL#
U303A
CD4011B
U301A
4025B
Q301
2N7002E
D300
MBR0540T
V_SUM
R309
0_ohm
D301
MBR0540T
+V_EXT_BAT
D302
MBR0540T
+V_INT_BAT
R300
49.9K
C302
0.1uF
U300A
MAX478CSA
Q300
FZT493
C301
0.1uF
D303
LM4040CIM3-5.0
5.0V, 0.5%
5V_BC
R302
15.0K
EXTBAT_PWR_SRC
EXTBAT_PWR_GATE
EXTBAT_OK#
U301B
4025B
Q302
2N7002E
INTBAT_PWR_SRC
R303
15.0K
INTBAT_PWR_GATE
U301C
4025B
R310
100K
Q303
2N7002E
INTBAT_OK
D305
MBR0540T
PWR_ON#
5V_BC
R304
100K
R305
100K
SW_ON
U303B
CD4011B
R306
2.0M
R307
10.0K
D304
MBR0540T
C303
1.0uF
5V_BC
C300
0.1uF
VDD
DIS
Q
THR
TR
R
GND
U302
LMC555
SW_OFF
U303C
CD4011B
U303D
CD4011B
R308
100K
PWR_OFF
SPARE
U300B
MAX478CSA
NOTE:
U301 & U303 power pins are connected to 5V_BC & GND.
SIZE
C
DWG NO.
52292
REV
F
SCALE
DO NOT SCALE DRAWING
SHEET 3 OF 8
HL

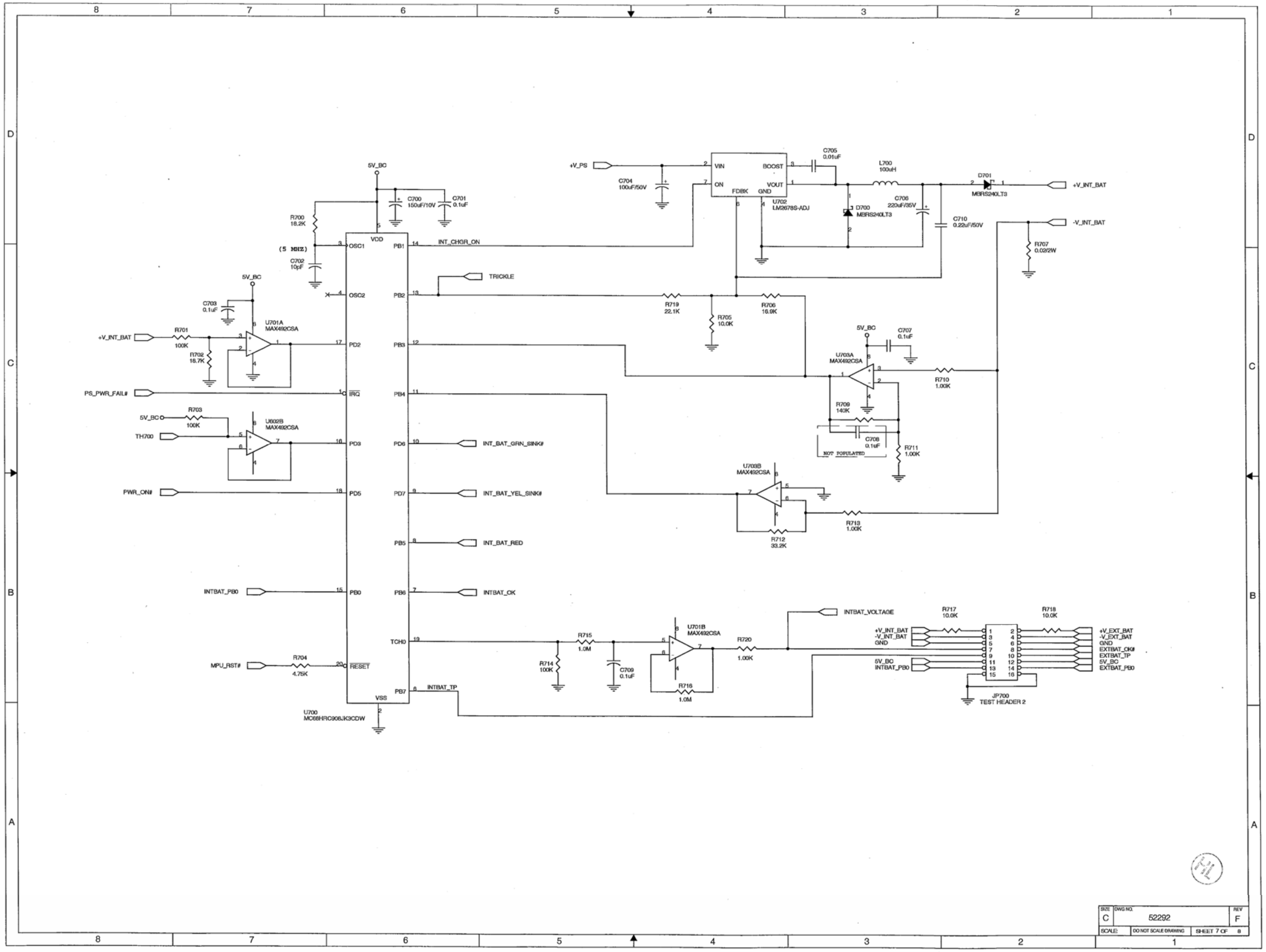

12V_2.5A
2.5V_REF
FCV_DAC_OUT
R400 4.75K
D400 LM4040CIM3-2.5 2.5V, 0.5%
U400 MAX5156BCEE
AGND
OUTA
FBA
REFA
CL#
CS#
DIN
SCLK
VDD
OUTB
FBB
REFB
PDL#
UPO
DOUT
DGND
5V_2.5A
EXH_VLV_DAC_OUT
R401 6.34K
R402 10.0K
R403 100K
R404 100K
R405 10.0K
R406 10.0K
DRVDAC_CS#
MOSI
SPICLK
U401A SN74HC125D
DMISO
R407 20.0K
R408 10.0K
20V_2.5A
C400 0.1uF
20V_VALVES
R409 1.00K
C401 0.1uF
Q400 TIP120
U402B OP292GS
R410 1.0/2W
JP3 FCV
FCV_CRT
U401B SN74HC125D
FCV2502_CS#
U401C SN74HC125D
U401D SN74HC125D
R411 10.0K
R412 15.0K
R413 10.0K
R414 10.0K
C402 0.1uF
U404B LM393/SO
2.5V_Ref
U403A CD4011B
U403B CD4011B
U403C CD4011B
OVRI_RST#
FCV_OVRCRT#
FCV_OVRCRT
HTR_DRV
HEATERON
Q401 MTD3055VL
R415 100K
R416 0.1/1W
R417 100K
R418 4.12K
R419 100K
R420 100K
C403 0.1uF
Q402 2N7002E
U404A LM393/SO
HTRON_FDBK
R421 33.2K
R422 10.0K 0.1%
C404 0.1uF
U405A OP292GS
R423 10.0K 0.1%
R424 15.0K 0.1%
R425 20.0K
U406B OP292GS
R426 475
R427 100K
12V_SOL
C405 0.1uF
Q403 MJD122
Q404 MJD127
C406 0.22uF/25V
R428 10.0K
R429 10.0K
EXH_VLV-
EXH_VLV+
U405B OP292GS
U406A OP292GS
C407 0.1uF
R432 475
Q405 MJD122
Q406 MJD127
C408 0.22uF/25V
R430 10.0K 0.1%
R431 15.0K 0.1%
SPARE
U403D CD4011B
SIZE C
DWG NO. 52292
REV F
SCALE
DO NOT SCALE DRAWING
SHEET 4 OF 8

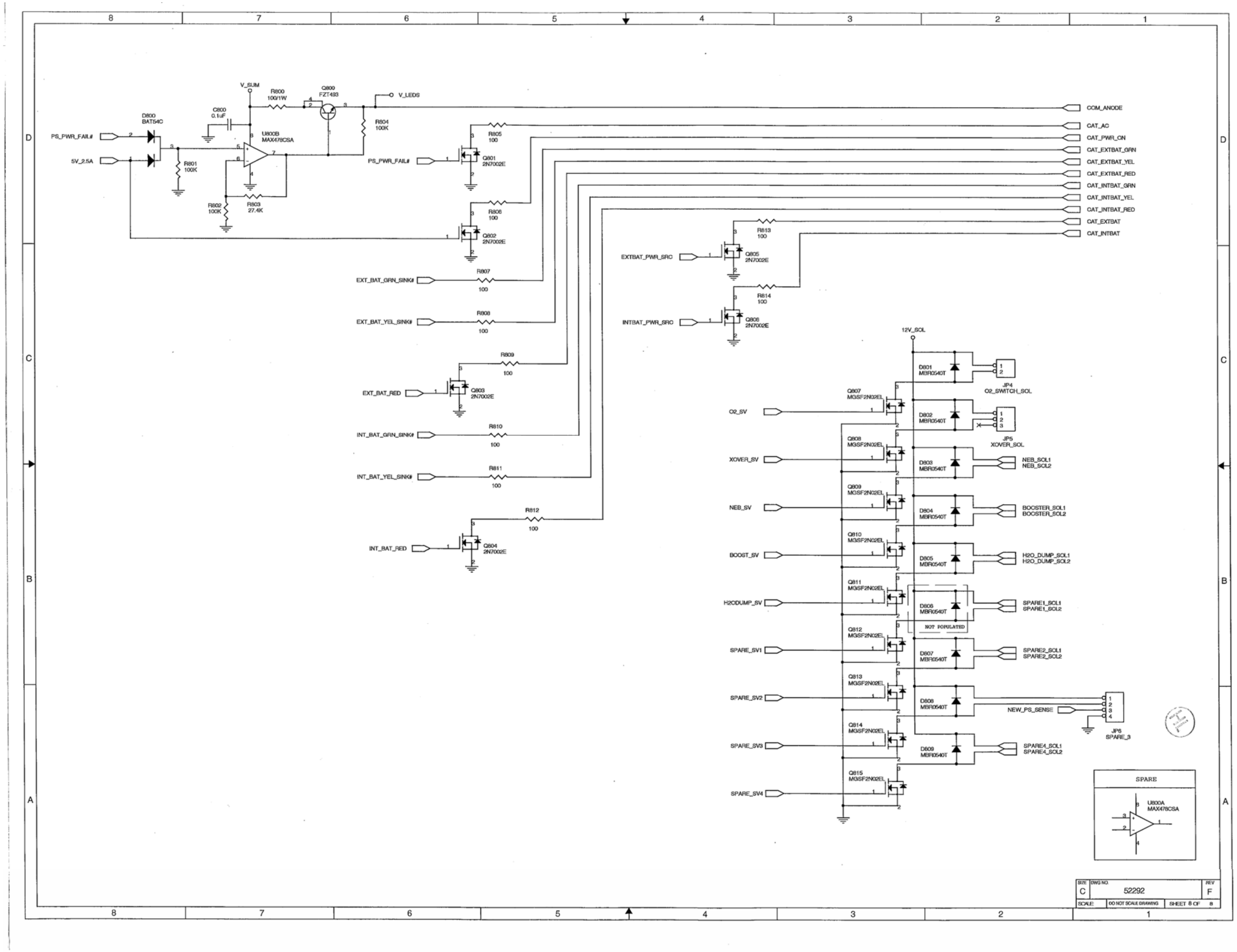
Note:
OVRI_RST# signal to be held low during start up.
After start up OVRI_RST will change to high and stay high until a RESET condition will arise.
The RESET will be done in diagnostics by aserting OVRI_RST low.

NOTE:
U403 power pins are connected to 5V_2.5A & GND.

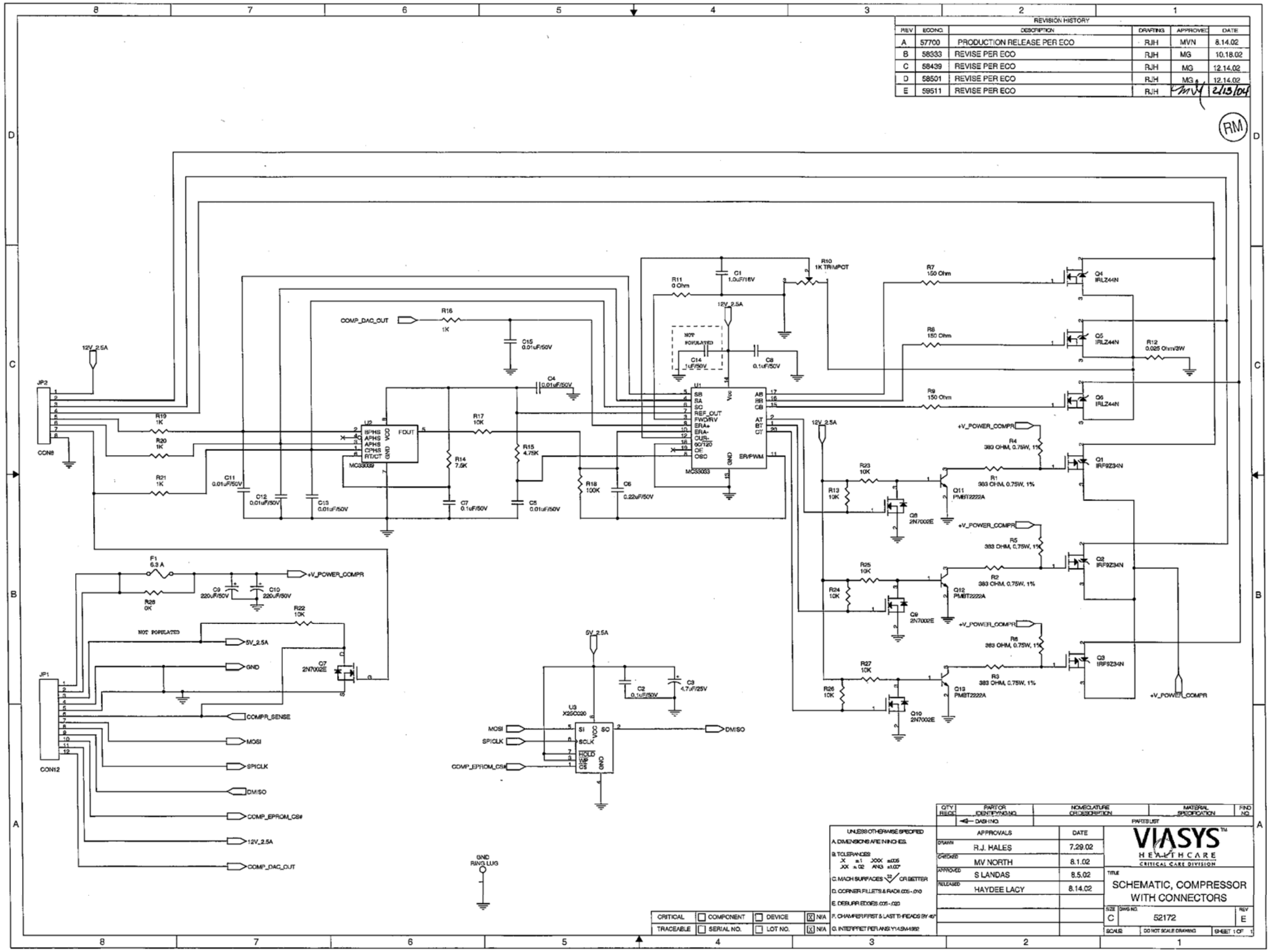

5V_2.5A
DRVADC_CS#
MOSI
SPICLK
DMISO
12V_SOL
R522 4.75K
INTBAT_VOLTAGE
20V_2.5A
R500 4.75K
5V_2.5A
R501 4.75K
FCV_CRT
R523 2.00K
R502 1.15K
R503 4.75K
C500 0.1uF
C501 10uF/35V
U501 TLV2548CD
CS#
CSTART#
SDIN
SCLK
ANAIN0
ANAIN1
ANAIN2
ANAIN3
ANAIN4
ANAIN5
ANAIN6
ANAIN7
+Vcc
FS
PWDN#
SDOUT
EOC
+REF
-REF
GND
+V_PWR_COMPR
R526 39.2K
R527 4.75K
NEW_PS_SENSE
R524 4.75K
R525 475
U402A OP292GS
EXH_TEMP
R506 10.0K
EXHAL_TEMP
R507 10.0K
R509 10.0K
R508 49.9K
5V_2.5A
R505 619K
R504 10.0K
COMPR_SENSE
C502 0.22uF/25V
U502A MM74HC4538M
RC
CX
VDD
+T
-T
VSS R
Q
COMPR_FAIL#
5V_2.5A
C506 0.1uF
12V_2.5A
C507 0.1uF
12V_2.5A
R510 4.75K
D500 LM4040BIM3-5.0 5V, 0.1%
4.1V_REF
MOSI
SPICLK
COMPFANDAC_CS#
U505 MAX522CSA
DIN
SCLK
REF
CS#
VDD
OUTA
OUTB
GND
C509 0.01uF
C508 0.01uF
U506A OP292GS
COMPR_DAC_OUT
R512 10.0K
R511 1.00K
U506B OP292GS
R513 10.0K
R514 20.0K
R515 100
R516 10.0K
C510 0.1uF
Q500 MTD3055VL
FAN
5V_2.5A
C504 0.1uF
5V_2.5A
C505 0.1uF
SPICLK+
SPICLK-
MOSI+
MOSI-
R518 100
R517 100
U503 DS90C402M
RI1+
RI1-
RI2+
RI2-
RO1
RO2
Vcc
GND
U504 DS90C401M
DI1
DI2
DO1+
DO1-
DO2+
DO2-
2SPICLK+
2SPICLK-
2MOSI+
2MOSI-
FROM THE TCA BOARD
TO THE MATE BOARD
MOSI
SPICLK
5V_2.5A
C511 0.1uF
U507 X25020S
SI
SO
SCLK
HOLD
WP
CS
VCC
GND
DMISO
DRV2502_CS#
5V_2.5A
R521 619K
R520 10.0K
FAN1_SENSE
C514 0.22uF/25V
U502B MM74HC4538M
FAN1_FAIL#
5V_2.5A
C512 0.1uF
5V_2.5A
C513 0.1uF
EMISO+
EMISO-
R519 100
U508 DS90C402M
EMISO
U509 DS90C401M
2EMISO+
2EMISO-
DMISO+
DMISO-
FROM THE MATE BOARD
TO THE TCA BOARD
SIZE C
DWG NO. 52292
REV F
SCALE
DO NOT SCALE DRAWING
SHEET 5 OF 8
8
7
6
5
4
3
2
1
D
C
B
A


5V_BC
C600
150uF/10V
C601
0.1uF
R600
18.2K
(5 MHZ)
C602
10pF
VDD
OSC1
OSC2
EXT_CHGR_ON
FLOAT
LOCRT
5V_BC
C603
0.1uF
U602A
MAX492CSA
+V_EXT_BAT
R601
100K
R602
18.7K
PD2
PS_PWR_FAIL#
IRQ
PWR_ON#
PD3
TRICKLE
PD5
EXTBAT_PB0
PB0
MPU_RST#
5V_BC
VCC
RESET
GND
U601
MAX809S/SOT23
R603
4.75K
RESET
VSS
U600
MC68HRC908JK3CDW
PB1
PB2
PB3
PB4
PB5
PD6
PD7
PB6
PD4
PB7
EXT_BAT_GRN_SINK#
EXT_BAT_YEL_SINK#
EXT_BAT_RED
EXTBAT_OK#
EXTBAT_TP
+V_PS
C604
100uF/50V
VIN
ON
BOOST
VOUT
FDBK
GND
U603
LM2678S-ADJ
C605
0.01uF
L600
100uH
D600
MBRS340T3
C606
220uF/35V
R604
69.8K
R605
3.01K
C609
0.22uF/50V
D601
MBRS340T3
+V_EXT_BAT
-V_EXT_BAT
R607
0.02/2W
R606
174K
D602
MBR0540T
D603
MBR0540T
R608
309
R609
750
5V_BC
C607
0.1uF
U605A
MAX492CSA
R612
1.00K
R610
140K
C608
0.1uF
NOT POPULATED
R611
1.00K
U605B
MAX492CSA
R614
1.00K
R613
33.2K
SIZE
C
DWG NO.
52292
REV
F
SCALE:
DO NOT SCALE DRAWING
SHEET 6 OF 8

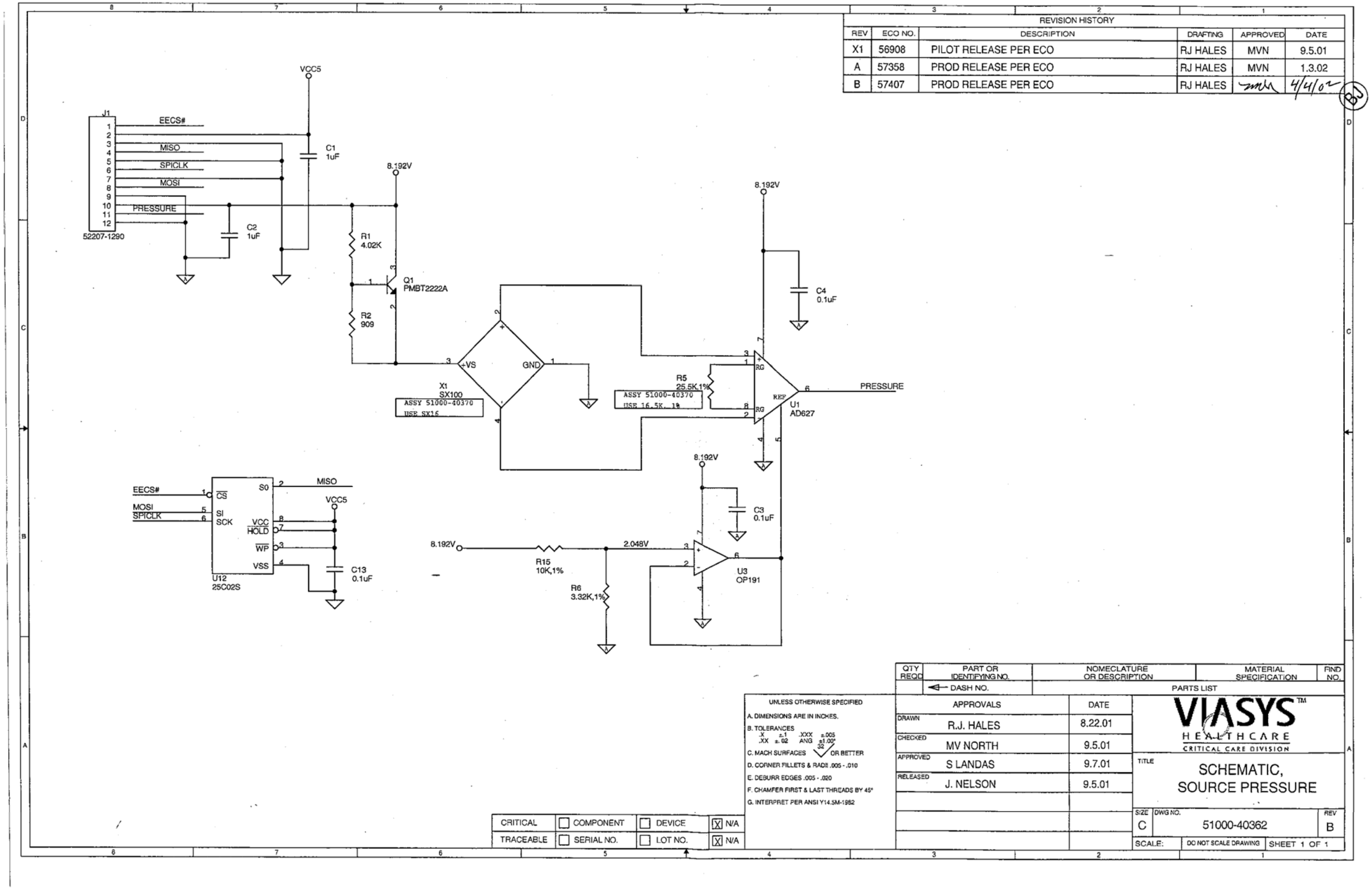

5V_BC
C700
150uF/10V
C701
0.1uF
R700
18.2K
(5 MHZ)
C702
10pF
VDD
OSC1
OSC2
PB1
INT_CHGR_ON
PB2
TRICKLE
C703
0.1uF
U701A
MAX492CSA
+V_INT_BAT
R701
100K
R702
18.7K
PD2
PB3
PS_PWR_FAIL#
IRQ
PB4
R703
100K
U602B
MAX492CSA
TH700
PD3
PD6
INT_BAT_GRN_SINK#
PWR_ON#
PD5
PD7
INT_BAT_YEL_SINK#
PB5
INT_BAT_RED
INTBAT_PB0
PB0
PB6
INTBAT_OK
TCH0
MPU_RST#
R704
4.75K
RESET
PB7
INTBAT_TP
VSS
U700
MC68HRC908JK3CDW
+V_PS
C704
100uF/50V
VIN
ON
BOOST
VOUT
FDBK
GND
U702
LM2678S-ADJ
C705
0.01uF
L700
100uH
D700
MBRS240LT3
C706
220uF/35V
C710
0.22uF/50V
D701
MBRS240LT3
+V_INT_BAT
-V_INT_BAT
R707
0.02/2W
R719
22.1K
R705
10.0K
R706
16.9K
C707
0.1uF
U703A
MAX492CSA
R710
1.00K
R709
140K
C708
0.1uF
NOT POPULATED
R711
1.00K
U703B
MAX492CSA
R713
1.00K
R712
33.2K
R715
1.0M
R714
100K
C709
0.1uF
U701B
MAX492CSA
R716
1.0M
R720
1.00K
INTBAT_VOLTAGE
R717
10.0K
R718
10.0K
+V_INT_BAT
-V_INT_BAT
GND
5V_BC
INTBAT_PB0
JP700
TEST HEADER 2
+V_EXT_BAT
-V_EXT_BAT
GND
EXTBAT_OK#
EXTBAT_TP
5V_BC
EXTBAT_PB0
SIZE
C
DWG NO.
52292
REV
F
SCALE
DO NOT SCALE DRAWING
SHEET 7 OF 8


8
7
6
5
4
3
2
1
D
C
B
A
V_SUM
R800
100/1W
Q800
FZT493
V_LEDS
C800
0.1uF
D800
BAT54C
R804
100K
PS_PWR_FAIL#
5V_2.5A
U800B
MAX478CSA
R801
100K
R802
100K
R803
27.4K
R805
100
Q801
2N7002E
PS_PWR_FAIL#
R806
100
Q802
2N7002E
EXT_BAT_GRN_SINK#
R807
100
EXT_BAT_YEL_SINK#
R808
100
R809
100
EXT_BAT_RED
Q803
2N7002E
INT_BAT_GRN_SINK#
R810
100
INT_BAT_YEL_SINK#
R811
100
R812
100
INT_BAT_RED
Q804
2N7002E
COM_ANODE
CAT_AC
CAT_PWR_ON
CAT_EXTBAT_GRN
CAT_EXTBAT_YEL
CAT_EXTBAT_RED
CAT_INTBAT_GRN
CAT_INTBAT_YEL
CAT_INTBAT_RED
CAT_EXTBAT
CAT_INTBAT
R813
100
EXTBAT_PWR_SRC
Q805
2N7002E
R814
100
INTBAT_PWR_SRC
Q806
2N7002E
12V_SOL
D801
MBR0540T
JP4
O2_SWITCH_SOL
Q807
MGSF2N02EL
O2_SV
D802
MBR0540T
JP5
XOVER_SOL
Q808
MGSF2N02EL
XOVER_SV
D803
MBR0540T
NEB_SOL1
NEB_SOL2
Q809
MGSF2N02EL
NEB_SV
D804
MBR0540T
BOOSTER_SOL1
BOOSTER_SOL2
Q810
MGSF2N02EL
BOOST_SV
D805
MBR0540T
H2O_DUMP_SOL1
H2O_DUMP_SOL2
Q811
MGSF2N02EL
H2ODUMP_SV
D806
MBR0540T
NOT POPULATED
SPARE1_SOL1
SPARE1_SOL2
Q812
MGSF2N02EL
SPARE_SV1
D807
MBR0540T
SPARE2_SOL1
SPARE2_SOL2
Q813
MGSF2N02EL
SPARE_SV2
D808
MBR0540T
NEW_PS_SENSE
JP6
SPARE_3
Q814
MGSF2N02EL
SPARE_SV3
D809
MBR0540T
SPARE4_SOL1
SPARE4_SOL2
Q815
MGSF2N02EL
SPARE_SV4
SPARE
U800A
MAX478CSA
SIZE
C
DWG NO.
52292
REV
F
SCALE
DO NOT SCALE DRAWING
SHEET 8 OF 8

PCB Compressor with Connectors


REVISION HISTORY
REV | ECO NO. | DESCRIPTION | DRAFTING | APPROVED | DATE
A | 57700 | PRODUCTION RELEASE PER ECO | RJH | MVN | 8.14.02
B | 58333 | REVISE PER ECO | RJH | MG | 10.18.02
C | 58439 | REVISE PER ECO | RJH | MG | 12.14.02
D | 58501 | REVISE PER ECO | RJH | MG | 12.14.02
E | 59511 | REVISE PER ECO | RJH | MVY | 2/13/04
RM
JP2
CON8
12V_2.5A
R19 1K
R20 1K
R21 1K
U2
MC33039
SPHS
APHS
APHS
CPHS
RT/CT
FOUT
VCC
GND
C11 0.01uF/50V
C12 0.01uF/50V
C13 0.01uF/50V
COMP_DAC_OUT
R16 1K
C15 0.01uF/50V
C4 0.01uF/50V
R17 10K
R14 7.5K
R15 4.75K
C7 0.1uF/50V
C5 0.01uF/50V
R18 100K
C6 0.22uF/50V
R11 0 Ohm
C1 1.0uF/16V
R10 1K TRIMPOT
NOT POPULATED
C14 .1uF/50V
C8 0.1uF/50V
U1
MC33033
SB
SA
SC
REF_OUT
FWD/RV
ERA+
ERA-
CUSL
60/120
OE
OSC
AB
BB
CB
AT
BT
CT
ER/PWM
R7 150 Ohm
R8 150 Ohm
R9 150 Ohm
Q4 IRLZ44N
Q5 IRLZ44N
Q6 IRLZ44N
R12 0.025 Ohm/3W
+V_POWER_COMPR
R4 383 OHM, 0.75W, 1%
R1 383 OHM, 0.75W, 1%
R5 383 OHM, 0.75W, 1%
R2 383 OHM, 0.75W, 1%
R6 383 OHM, 0.75W, 1%
R3 383 OHM, 0.75W, 1%
Q1 IRF9Z34N
Q2 IRF9Z34N
Q3 IRF9Z34N
R23 10K
R25 10K
R27 10K
R13 10K
R24 10K
R26 10K
Q11 PMBT2222A
Q12 PMBT2222A
Q13 PMBT2222A
Q8 2N7002E
Q9 2N7002E
Q10 2N7002E
F1 6.3 A
R29 0K
C9 220uF/50V
C10 220uF/50V
R22 10K
NOT POPULATED
5V_2.5A
GND
C7 2N7002E
JP1
CON12
COMPR_SENSE
MOSI
SPICLK
DMISO
COMP_EPROM_CS#
12V_2.5A
COMP_DAC_OUT
U3 X25C020
SI
SO
SCK
HOLD
WP
CS
VCC
GND
C2 0.1uF/50V
C3 4.7uF/25V
MOSI
SPICLK
COMP_EPROM_CS#
DMISO
GND RING LUG
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | FIND NO.
DASH NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XXX ±.005 .XX ±.02 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005-.010
E. DEBURR EDGES .005-.020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982
CRITICAL ☐ COMPONENT ☐ DEVICE ☒ N/A
TRACEABLE ☐ SERIAL NO. ☐ LOT NO. ☒ N/A
APPROVALS | DATE
DRAWN R.J. HALES | 7.29.02
CHECKED MV NORTH | 8.1.02
APPROVED S LANDAS | 8.5.02
RELEASED HAYDEE LACY | 8.14.02
VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION
TITLE SCHEMATIC, COMPRESSOR WITH CONNECTORS
SIZE C
DWG NO. 52172
REV E
SCALE
DO NOT SCALE DRAWING
SHEET 1 OF 1

PCBA, Supply Pressure


J1
EECS#
MISO
SPICLK
MOSI
PRESSURE
52207-1290
VCC5
C1
1uF
C2
1uF
8.192V
R1
4.02K
Q1
PMBT2222A
R2
909
+VS
GND
X1
SX100
ASSY 51000-40370
USE SX16
R5
25.5K,1%
ASSY 51000-40370
USE 16.5K, 1%
RG
REF
U1
AD627
PRESSURE
C4
0.1uF
C3
0.1uF
U12
25C02S
CS
SI
SCK
S0
VCC
HOLD
WP
VSS
C13
0.1uF
R15
10K,1%
2.048V
R6
3.32K,1%
U3
OP191
BJ

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56908	PILOT RELEASE PER ECO	RJ HALES	MVN	9.5.01
A	57358	PROD RELEASE PER ECO	RJ HALES	MVN	1.3.02
B	57407	PROD RELEASE PER ECO	RJ HALES	mvn	4/4/02

QTY REQD	PART OR IDENTIFYING NO.	NOMECLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XXX ±.005 .XX ±.02 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

APPROVALS		DATE
DRAWN	R.J. HALES	8.22.01
CHECKED	MV NORTH	9.5.01
APPROVED	S LANDAS	9.7.01
RELEASED	J. NELSON	9.5.01

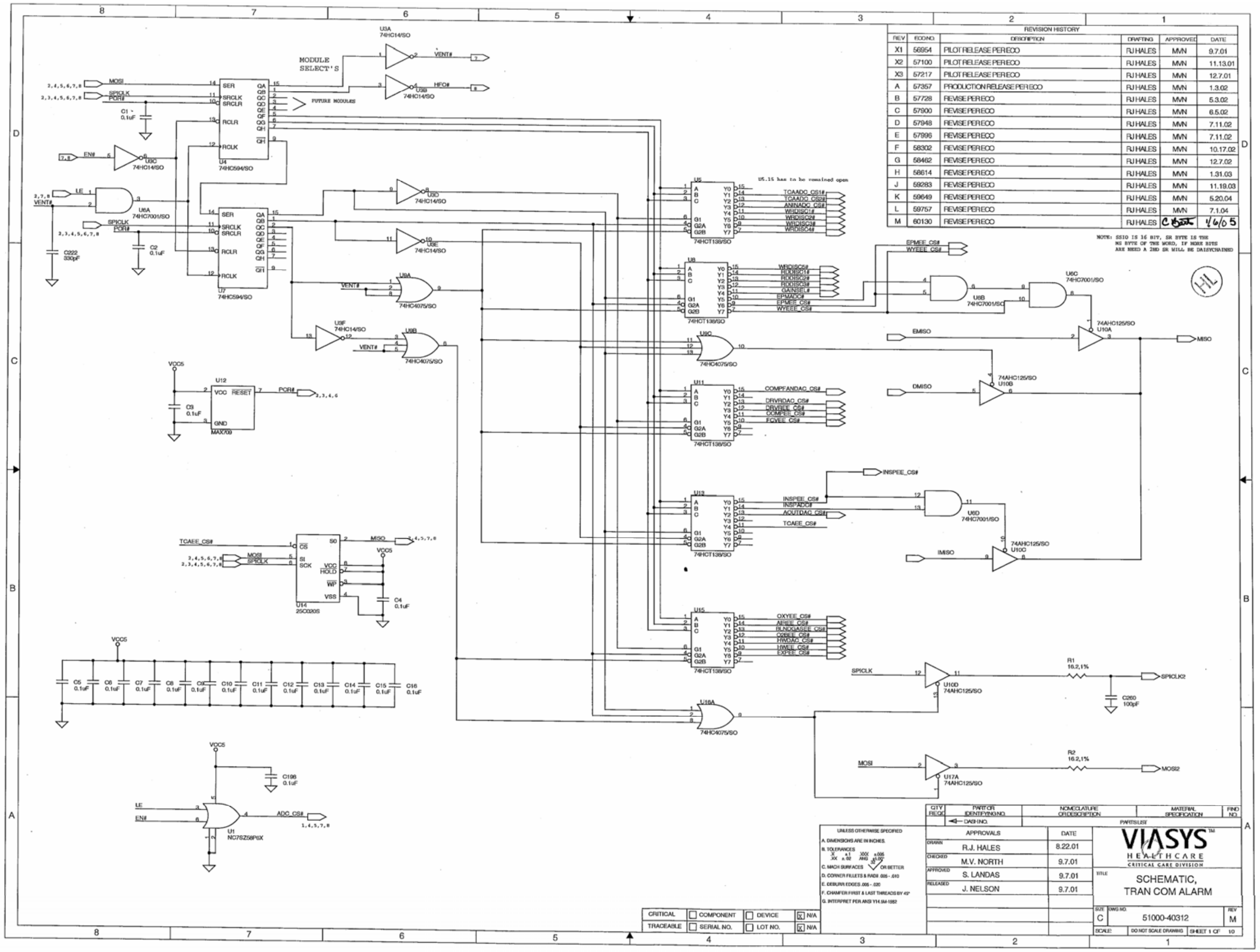
VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION

TITLE SCHEMATIC, SOURCE PRESSURE

SIZE	DWG NO.	REV
C	51000-40362	B

SCALE: DO NOT SCALE DRAWING SHEET 1 OF 1

Trans Com Alarm


MODULE SELECT'S
U3A 74HC14/SO
VENT#
U3B 74HC14/SO
HFO#
FUTURE MODULES
MOSI
SPICLK
POR#
2,4,5,6,7,8
2,3,4,5,6,7,8
C1 0.1uF
SER
SRCLK
SRCLR
RCLR
RCLK
QA QB QC QD QE QF QG QH
U4 74HC594/SO
EN#
U3C 74HC14/SO
LE
2,7,8
U6A 74HC7001/SO
C222 330pF
C2 0.1uF
U7 74HC594/SO
U3D 74HC14/SO
U3E 74HC14/SO
U9A 74HC4075/SO
U3F 74HC14/SO
U9B 74HC4075/SO
U9C 74HC4075/SO
U5 74HCT138/SO
U5.15 has to be remained open
TCAADC_CS1#
TCAADC_CS2#
ANINADC_CS#
WRDISC1#
WRDISC2#
WRDISC3#
WRDISC4#
U8 74HCT138/SO
WRDISC5#
RDDISC1#
RDDISC2#
RDDISC3#
GAINSEL#
EPMADC#
EPMEE_CS#
WYEEE_CS#
U6B 74HC7001/SO
U6C 74HC7001/SO
EMISO
74AHC125/SO U10A
MISO
DMISO
74AHC125/SO U10B
U11 74HCT138/SO
COMPFANDAC_CS#
DRVRDAC_CS#
DRVBEE_CS#
COMPEE_CS#
FCVEE_CS#
VCC5
U12
VCC
RESET
GND
MAX709
C3 0.1uF
2,3,4,6
INSPEE_CS#
U13 74HCT138/SO
INSPADC#
AOUTDAC_CS#
TCAEE_CS#
U6D 74HC7001/SO
IMISO
74AHC125/SO U10C
CS
SI
SCK
S0
HOLD
WP
VSS
U14 25C020S
C4 0.1uF
2,4,5,7,8
U15 74HCT138/SO
OXYEE_CS#
AIREE_CS#
BLNDGASEE_CS#
O2BEE_CS#
HWDAC_CS#
HWEE_CS#
EXPEE_CS#
C5 0.1uF
C6 0.1uF
C7 0.1uF
C8 0.1uF
C9 0.1uF
C10 0.1uF
C11 0.1uF
C12 0.1uF
C13 0.1uF
C14 0.1uF
C15 0.1uF
C16 0.1uF
SPICLK
U10D 74AHC125/SO
R1 16.2,1%
SPICLK2
C260 100pF
U16A 74HC4075/SO
MOSI
U17A 74AHC125/SO
R2 16.2,1%
MOSI2
C198 0.1uF
ADC_CS#
1,4,5,7,8
U1 NC7SZ58P6X
A B C D
1 2 3 4 5 6 7 8

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56954	PILOT RELEASE PER ECO	RJ HALES	MVN	9.7.01
X2	57100	PILOT RELEASE PER ECO	RJ HALES	MVN	11.13.01
X3	57217	PILOT RELEASE PER ECO	RJ HALES	MVN	12.7.01
A	57357	PRODUCTION RELEASE PER ECO	RJ HALES	MVN	1.3.02
B	57728	REVISE PER ECO	RJ HALES	MVN	5.3.02
C	57900	REVISE PER ECO	RJ HALES	MVN	6.5.02
D	57948	REVISE PER ECO	RJ HALES	MVN	7.11.02
E	57996	REVISE PER ECO	RJ HALES	MVN	7.11.02
F	58302	REVISE PER ECO	RJ HALES	MVN	10.17.02
G	58462	REVISE PER ECO	RJ HALES	MVN	12.7.02
H	58614	REVISE PER ECO	RJ HALES	MVN	1.31.03
J	59283	REVISE PER ECO	RJ HALES	MVN	11.19.03
K	59649	REVISE PER ECO	RJ HALES	MVN	5.20.04
L	59757	REVISE PER ECO	RJ HALES	MVN	7.1.04
M	60130	REVISE PER ECO	RJ HALES	C Bost	1/6/05

NOTE: SSIO IS 16 BIT, SR BYTE IS THE MS BYTE OF THE WORD, IF MORE BITS ARE NEED A 2ND SR WILL BE DAISYCHAINED

HL

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◄— DASH NO.	PARTS LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XX ±.02 .XXX ±.005 ANG ±1.00°
C. MACH SURFACES 32 OR BETTER
D. CORNER FILLETS & RADII .005 - .010
E. DEBURR EDGES .005 - .020
F. CHAMFER FIRST & LAST THREADS BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

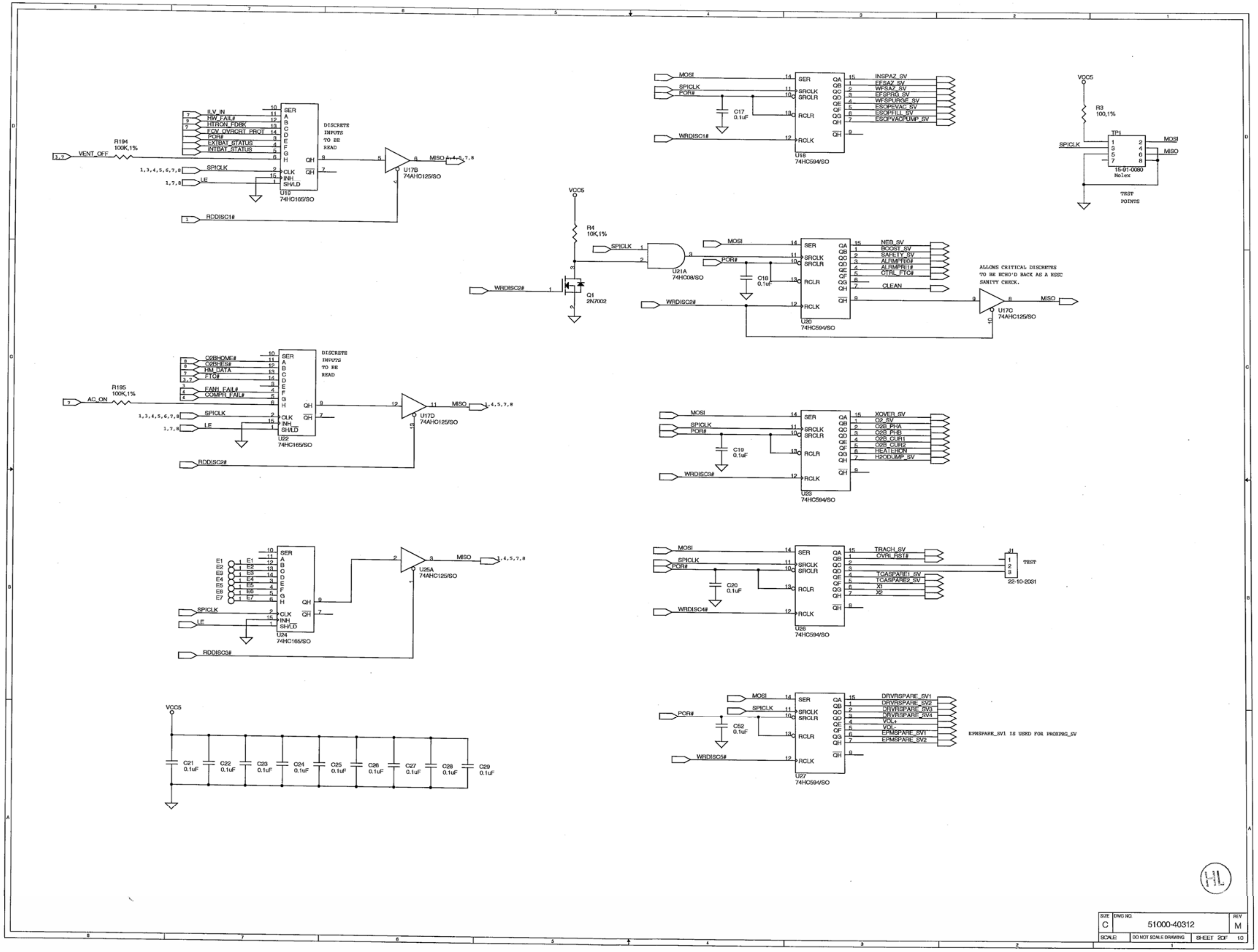
APPROVALS		DATE
DRAWN	R.J. HALES	8.22.01
CHECKED	M.V. NORTH	9.7.01
APPROVED	S. LANDAS	9.7.01
RELEASED	J. NELSON	9.7.01

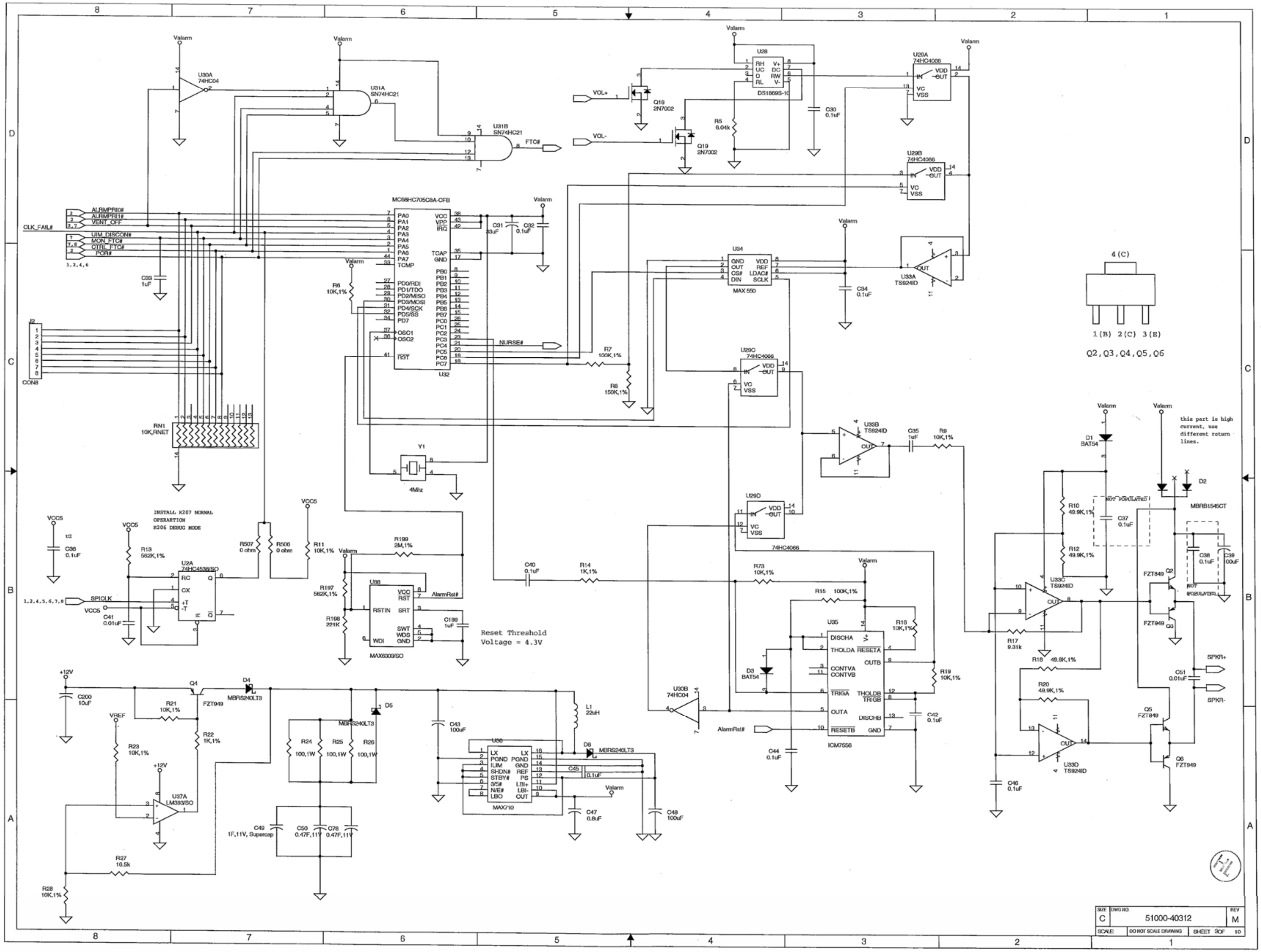
VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION

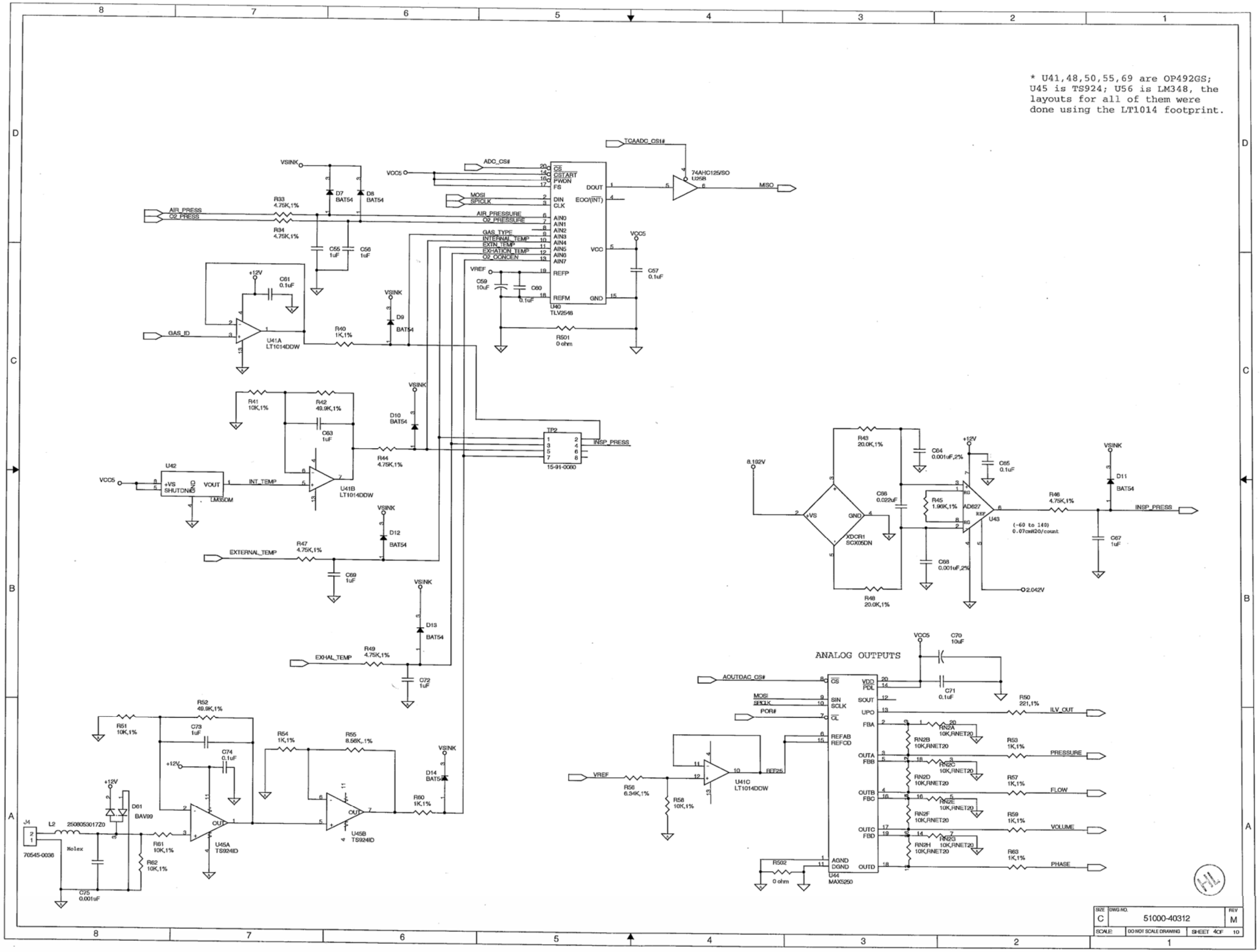
TITLE SCHEMATIC, TRAN COM ALARM

SIZE C DWG NO. 51000-40312 REV M
SCALE DO NOT SCALE DRAWING SHEET 1 OF 10

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

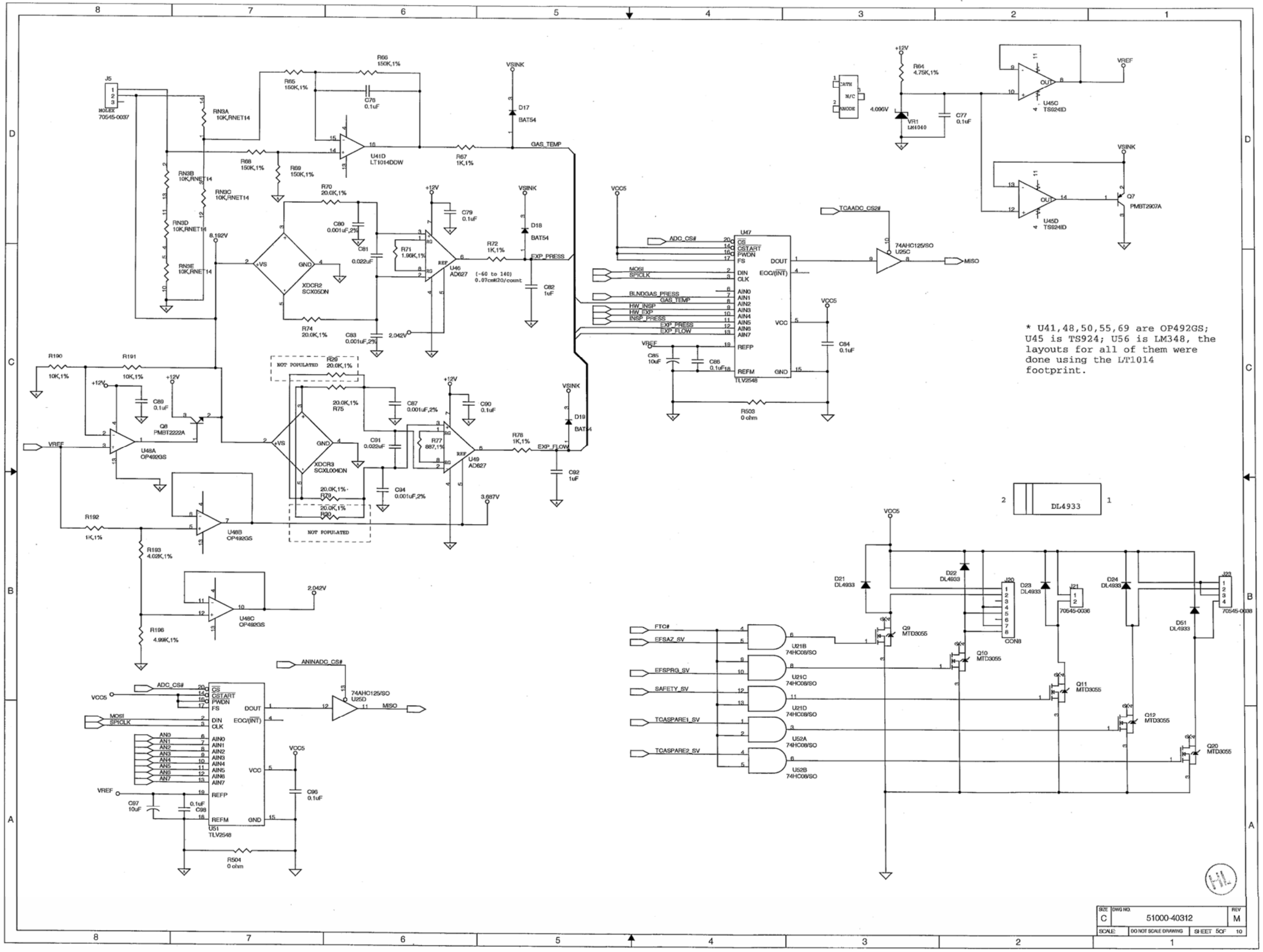

ILV_IN
HW_FAIL#
HTRON_FDBK
FCV_OVRCRT_PROT
POR#
EXTBAT_STATUS
INTBAT_STATUS
VENT_OFF
R194
100K,1%
SPICLK
LE
1,3,4,5,6,7,8
1,7,8
SER
CLK
INH
SH/LD
QH
U19
74HC165/SO
DISCRETE
INPUTS
TO BE
READ
U17B
74AHC125/SO
MISO 1,4,5,7,8
RDDISC1#
MOSI
POR#
SRCLK
SRCLR
RCLR
RCLK
C17
0.1uF
WRDISC1#
U18
74HC594/SO
INSPAZ_SV
EFSAZ_SV
WFSAZ_SV
EFSPRG_SV
WFSPURGE_SV
ESOPEVAC_SV
ESOPFILL_SV
ESOPVACPUMP_SV
VCC5
R3
100,1%
TP1
15-91-0080
Molex
TEST
POINTS
R4
10K,1%
Q1
2N7002
WRDISC2#
U21A
74HC08/SO
C18
0.1uF
U20
74HC594/SO
NEB_SV
BOOST_SV
SAFETY_SV
ALRMPRI0#
ALRMPRI1#
CTRL_FTC#
CLEAN
ALLOWS CRITICAL DISCRETES
TO BE ECHO'D BACK AS A HSSC
SANITY CHECK.
U17C
74AHC125/SO
O2BHOME#
O2BHES#
HM_DATA
FTC#
FAN1_FAIL#
COMPR_FAIL#
AC_ON
R195
100K,1%
U22
74HC165/SO
U17D
74AHC125/SO
RDDISC2#
C19
0.1uF
WRDISC3#
U23
74HC594/SO
XOVER_SV
O2_SV
O2B_PHA
O2B_PHB
O2B_CUR1
O2B_CUR2
HEATERON
H2ODUMP_SV
E1
E2
E3
E4
E5
E6
E7
U24
74HC165/SO
U25A
74AHC125/SO
RDDISC3#
C20
0.1uF
WRDISC4#
U26
74HC594/SO
TRACH_SV
OVRI_RST#
TCASPARE1_SV
TCASPARE2_SV
X1
X2
J1
TEST
22-10-2031
C21 0.1uF
C22 0.1uF
C23 0.1uF
C24 0.1uF
C25 0.1uF
C26 0.1uF
C27 0.1uF
C28 0.1uF
C29 0.1uF
C52
0.1uF
WRDISC5#
U27
74HC594/SO
DRVRSPARE_SV1
DRVRSPARE_SV2
DRVRSPARE_SV3
DRVRSPARE_SV4
VOL+
VOL-
EPMSPARE_SV1
EPMSPARE_SV2
EPMSPARE_SV1 IS USED FOR PROXPRG_SV
HL
SIZE C
DWG NO. 51000-40312
REV M
SCALE:
DO NOT SCALE DRAWING
SHEET 2 OF 10


U30A 74HC04
U31A SN74HC21
U31B SN74HC21
FTC#
U28 DS1869S-10
Q18 2N7002
Q19 2N7002
VOL+
VOL-
R5 6.04k
C30 0.1uF
U29A 74HC4066
U29B 74HC4066
U29C 74HC4066
U29D 74HC4066
MC68HC705C8A-CFB
U32
ALRMPRI0#
ALRMPRI1#
VENT_OFF
CLK_FAIL#
UIM_DISCON#
MON_FTC#
CTRL_FTC#
POR#
C31 33uF
C32 0.1uF
C33 1uF
R6 10K,1%
NURSE#
R7 100K,1%
R8 150K,1%
U34 MAX 550
C34 0.1uF
U33A TS924ID
J2 CON8
RN1 10K,RNET
Y1 4Mhz
Valarm
VCC5
INSTALL R207 NORMAL OPERARTION
R206 DEBUG MODE
C36 0.1uF
R13 562K,1%
U2A 74HC4538/SO
SPICLK
C41 0.01uF
R507 0 ohm
R506 0 ohm
R11 10K,1%
R199 2M,1%
R197 562K,1%
R198 221K
U88 MAX6303/SO
AlarmRst#
C199 1uF
Reset Threshold Voltage = 4.3V
C40 0.1uF
R14 1K,1%
R73 10K,1%
R15 100K,1%
R16 10K,1%
U35 ICM7556
D3 BAT54
U30B 74HC04
C44 0.1uF
C42 0.1uF
R19 10K,1%
U33B TS924ID
C35 1uF
R9 10K,1%
D1 BAT54
R10 49.9K,1%
R12 49.9K,1%
C37 0.1uF
NOT POPULATED
D2 MBRB1545CT
this part is high current, use different return lines.
C38 0.1uF
C39 100uF
U33C TS924ID
R17 9.31k
R18 49.9K,1%
R20 49.9K,1%
U33D TS924ID
C46 0.1uF
Q2 FZT849
Q3 FZT949
Q5 FZT849
Q6 FZT949
C51 0.01uF
SPKR+
SPKR-
4(C)
1(B) 2(C) 3(E)
Q2,Q3,Q4,Q5,Q6
+12V
C200 10uF
Q4 FZT949
D4 MBRS240LT3
D5 MBRS240LT3
R21 10K,1%
R22 1K,1%
VREF
R23 10K,1%
U37A LM393/SO
R27 16.5k
R28 10K,1%
R24 100,1W
R25 100,1W
R26 100,1W
C43 100uF
C49 1F,11V, Supercap
C50 0.47F,11V
C78 0.47F,11V
L1 22uH
D6 MBRS240LT3
U86 MAX710
C45 0.1uF
C47 6.8uF
C48 100uF
SIZE C
DWG NO. 51000-40312
REV M
SCALE
DO NOT SCALE DRAWING
SHEET 3 OF 10



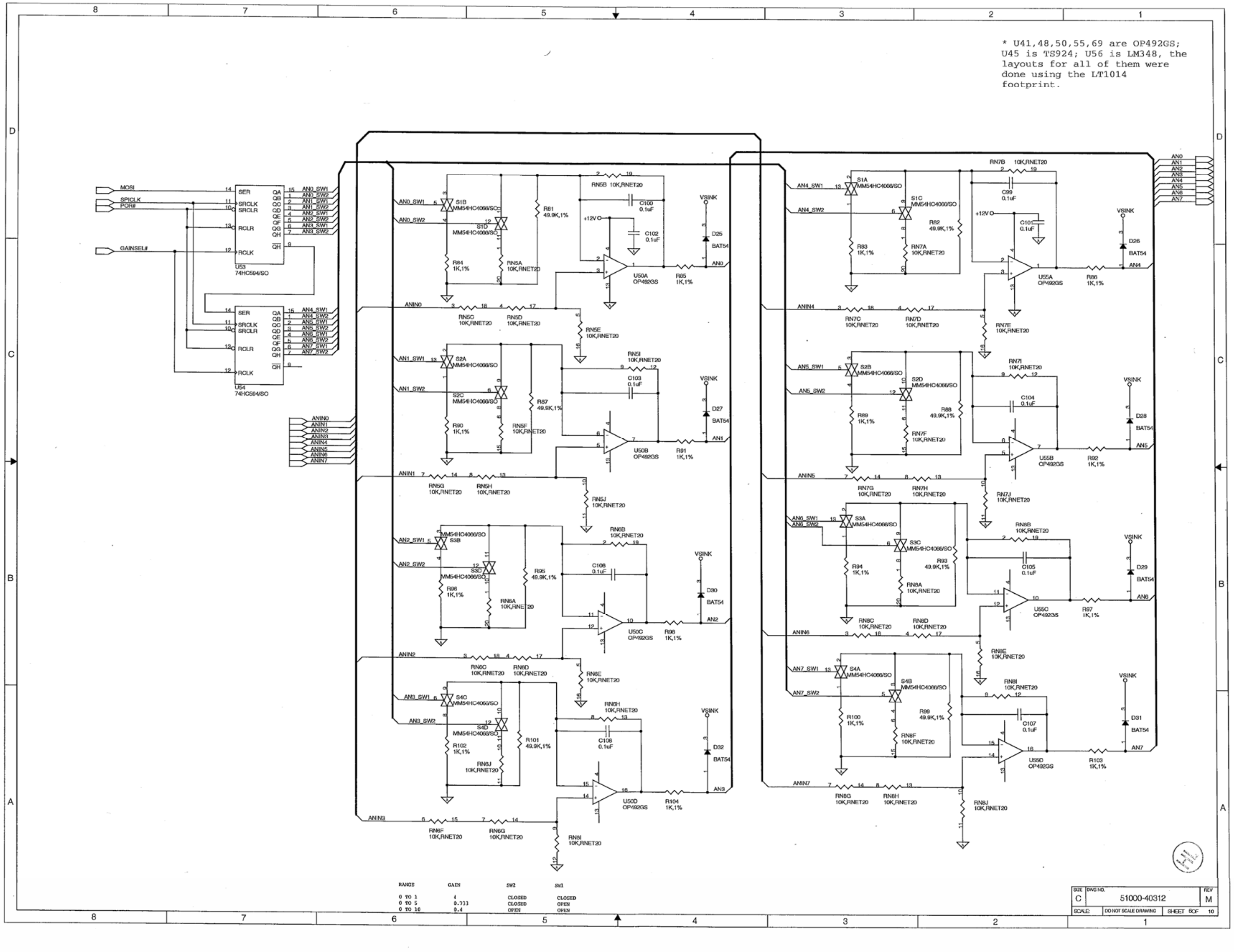
* U41,48,50,55,69 are OP492GS; U45 is TS924; U56 is LM348, the layouts for all of them were done using the LT1014 footprint.

ADC_CS#
VCC5
VSINK
D7 BAT54
D8 BAT54
R33 4.75K,1%
R34 4.75K,1%
AIR_PRESS
O2_PRESS
MOSI
SPICLK
AIR_PRESSURE
O2_PRESSURE
GAS_TYPE
INTERNAL_TEMP
EXTN_TEMP
EXHATION_TEMP
O2_CONCEN
C55 1uF
C56 1uF
VREF
C59 10uF
C60 0.1uF
U40 TLV2548
R501 0 ohm
C57 0.1uF
CS
CSTART
PWDN
FS
DIN
CLK
DOUT
EOC/(INT)
AIN0
AIN1
AIN2
AIN3
AIN4
AIN5
AIN6
AIN7
REFP
REFM
VCC
GND
TCAADC_CS1#
74AHC125/SO U25B
MISO
+12V
C61 0.1uF
GAS_ID
U41A LT1014DDW
R40 1K,1%
D9 BAT54
R41 10K,1%
R42 49.9K,1%
C63 1uF
D10 BAT54
R44 4.75K,1%
U42
+VS
SHUTDN
GND
VOUT
LM35DM
INT_TEMP
U41B LT1014DDW
TP2
15-91-0080
INSP_PRESS
D12 BAT54
EXTERNAL_TEMP
R47 4.75K,1%
C69 1uF
D13 BAT54
EXHAL_TEMP
R49 4.75K,1%
C72 1uF
R43 20.0K,1%
C64 0.001uF,2%
C65 0.1uF
8.192V
C66 0.022uF
R45 1.90K,1%
+VS
GND
XDCR1 SCX05DN
AD627
U43
REF
RG
R46 4.75K,1%
D11 BAT54
C67 1uF
(-60 to 140) 0.07cmH2O/count
C68 0.001uF,2%
R48 20.0K,1%
2.042V
ANALOG OUTPUTS
VCC5
C70 10uF
AOUTDAC_CS#
MOSI
SPICLK
POR#
CS
SIN
SCLK
CL
REFAB
REFCD
VDD
PDL
SOUT
UPO
FBA
OUTA
FBB
OUTB
FBC
OUTC
FBD
OUTD
AGND
DGND
U44 MAX5250
C71 0.1uF
R50 221,1%
ILV_OUT
RN2A 10K,RNET20
RN2B 10K,RNET20
RN2C 10K,RNET20
RN2D 10K,RNET20
RN2E 10K,RNET20
RN2F 10K,RNET20
RN2G 10K,RNET20
RN2H 10K,RNET20
R53 1K,1%
PRESSURE
R57 1K,1%
FLOW
R59 1K,1%
VOLUME
R63 1K,1%
PHASE
VREF
R56 6.34K,1%
R58 10K,1%
U41C LT1014DDW
REF25
R502 0 ohm
R51 10K,1%
R52 49.9K,1%
C73 1uF
C74 0.1uF
R54 1K,1%
R55 8.56K,1%
D14 BAT54
R60 1K,1%
J4
L2 2508053017Z0
D61 BAV99
R61 10K,1%
R62 10K,1%
U45A TS924D
U45B TS924D
70545-0036
Molex
C75 0.001uF
SIZE C
DWG NO. 51000-40312
REV M
SCALE
DO NOT SCALE DRAWING
SHEET 4 OF 10


J5
MOLEX
70545-0037
RN3A
10K,RNET14
RN3B
10K,RNET14
RN3C
10K,RNET14
RN3D
10K,RNET14
RN3E
10K,RNET14
R65
150K,1%
R66
150K,1%
C78
0.1uF
R68
150K,1%
R69
150K,1%
U41D
LT1014DDW
R67
1K,1%
GAS_TEMP
VSINK
D17
BAT54
R70
20.0K,1%
C80
0.001uF,2%
8.192V
XDCR2
SCX05DN
+VS
GND
C81
0.022uF
R71
1.96K,1%
+12V
C79
0.1uF
U46
AD627
R72
1K,1%
EXP_PRESS
D18
BAT54
(-60 to 140)
0.07cmH2O/count
C82
1uF
R74
20.0K,1%
C83
0.001uF,2%
2.042V
VCC5
ADC_CS#
U47
CS
CSTART
PWDN
FS
DOUT
EOC/(INT)
DIN
CLK
MOSI
SPICLK
BLNDGAS_PRESS
GAS_TEMP
HW_INSP
HW_EXP
INSP_PRESS
EXP_PRESS
EXP_FLOW
AIN0
AIN1
AIN2
AIN3
AIN4
AIN5
AIN6
AIN7
VCC
REFP
REFM
GND
VREF
C85
10uF
C86
0.1uF
TLV2548
C84
0.1uF
R503
0 ohm
TCAADC_CS2#
74AHC125/SO
U25C
MISO
+12V
R64
4.75K,1%
CATH
N/C
ANODE
4.096V
VR1
LM4040
C77
0.1uF
U45C
TS924ID
VREF
OUT
U45D
TS924ID
Q7
PMBT2907A
R190
10K,1%
R191
10K,1%
C89
0.1uF
Q8
PMBT2222A
U48A
OP492GS
NOT POPULATED
R29
20.0K,1%
20.0K,1%
R75
C87
0.001uF,2%
C90
0.1uF
XDCR3
SCXL004DN
C91
0.022uF
R77
887,1%
U49
AD627
R78
1K,1%
EXP_FLOW
D19
BAT54
C92
1uF
20.0K,1%
R76
C94
0.001uF,2%
3.687V
20.0K,1%
R80
NOT POPULATED
R192
1K,1%
U48B
OP492GS
R193
4.02K,1%
U48C
OP492GS
2.042V
R196
4.99K,1%
ANINADC_CS#
ADC_CS#
VCC5
74AHC125/SO
U25D
MISO
AN0
AN1
AN2
AN3
AN4
AN5
AN6
AN7
C96
0.1uF
C97
10uF
C98
0.1uF
U51
TLV2548
R504
0 ohm
DL4933
VCC5
D21
DL4933
D22
DL4933
J20
D23
DL4933
J21
70545-0036
D24
DL4933
J23
70545-0038
D51
DL4933
CON8
FTC#
EFSAZ_SV
EFSPRG_SV
SAFETY_SV
TCASPARE1_SV
TCASPARE2_SV
U21B
74HC08/SO
U21C
74HC08/SO
U21D
74HC08/SO
U52A
74HC08/SO
U52B
74HC08/SO
Q9
MTD3055
Q10
MTD3055
Q11
MTD3055
Q12
MTD3055
Q20
MTD3055
8
7
6
5
4
3
2
1
D
C
B
A

* U41,48,50,55,69 are OP492GS;
U45 is TS924; U56 is LM348, the
layouts for all of them were
done using the LT1014
footprint.

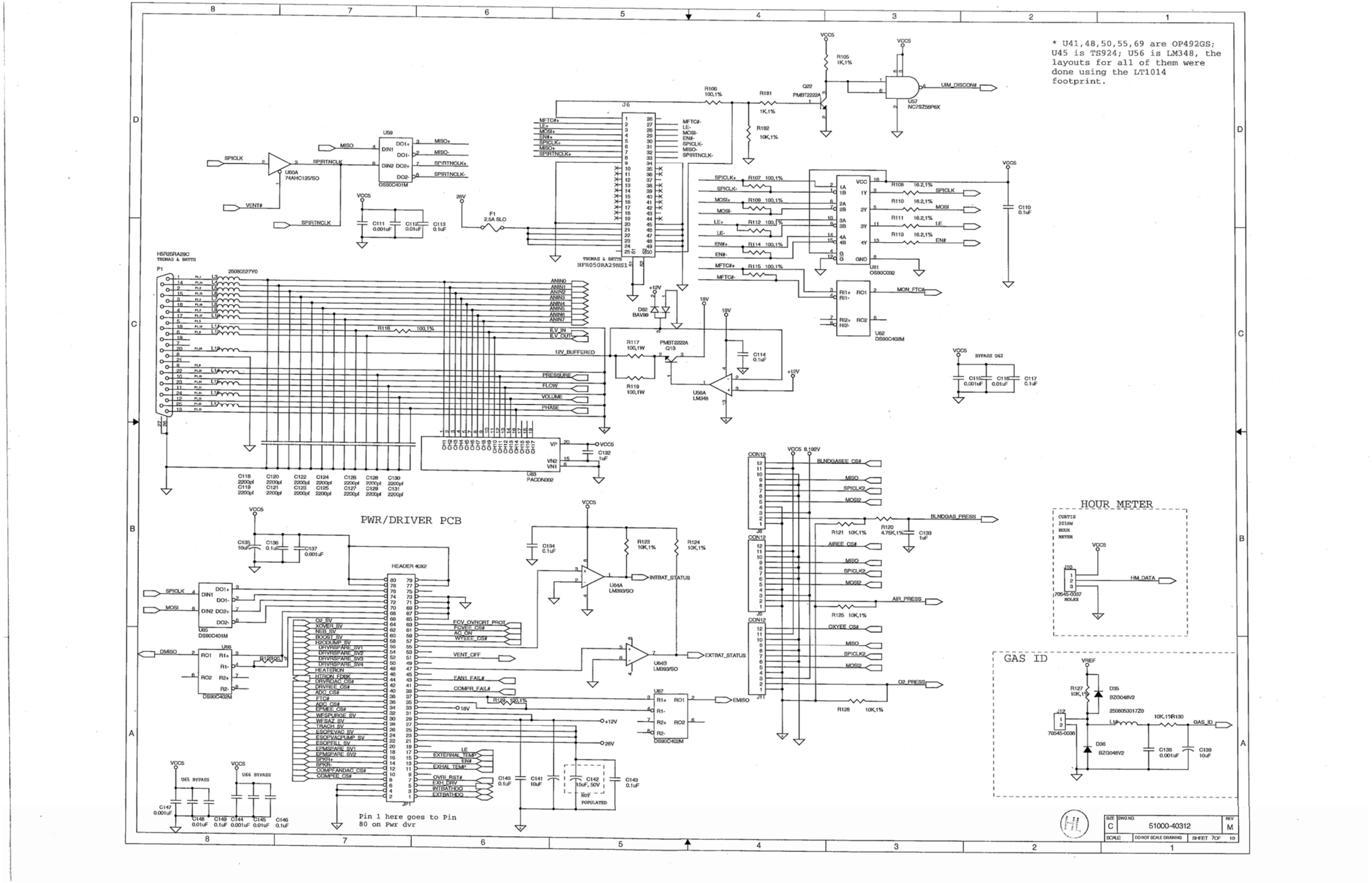
SIZE	DWG NO.		REV
C	51000-40312		M
SCALE	DO NOT SCALE DRAWING	SHEET 5 OF 10	


MOSI
SPICLK
POR#
GAINSEL#
U53
74HC594/SO
U54
74HC594/SO
SER
SRCLK
SRCLR
RCLR
RCLK
ANIN0
ANIN1
ANIN2
ANIN3
ANIN4
ANIN5
ANIN6
ANIN7
AN0
AN1
AN2
AN3
AN4
AN5
AN6
AN7
AN0_SW1
AN0_SW2
AN1_SW1
AN1_SW2
AN2_SW1
AN2_SW2
AN3_SW1
AN3_SW2
AN4_SW1
AN4_SW2
AN5_SW1
AN5_SW2
AN6_SW1
AN6_SW2
AN7_SW1
AN7_SW2
MM54HC4066/SO
U50A OP492GS
U50B OP492GS
U50C OP492GS
U50D OP492GS
U55A OP492GS
U55B OP492GS
U55C OP492GS
U55D OP492GS
VSINK
+12V
BAT54
10K,RNET20
49.9K,1%
1K,1%
0.1uF

* U41,48,50,55,69 are OP492GS;
U45 is TS924; U56 is LM348, the
layouts for all of them were
done using the LT1014
footprint.

RANGE	GAIN	SW2	SW1
0 TO 1	4	CLOSED	CLOSED
0 TO 5	0.733	CLOSED	OPEN
0 TO 10	0.4	OPEN	OPEN

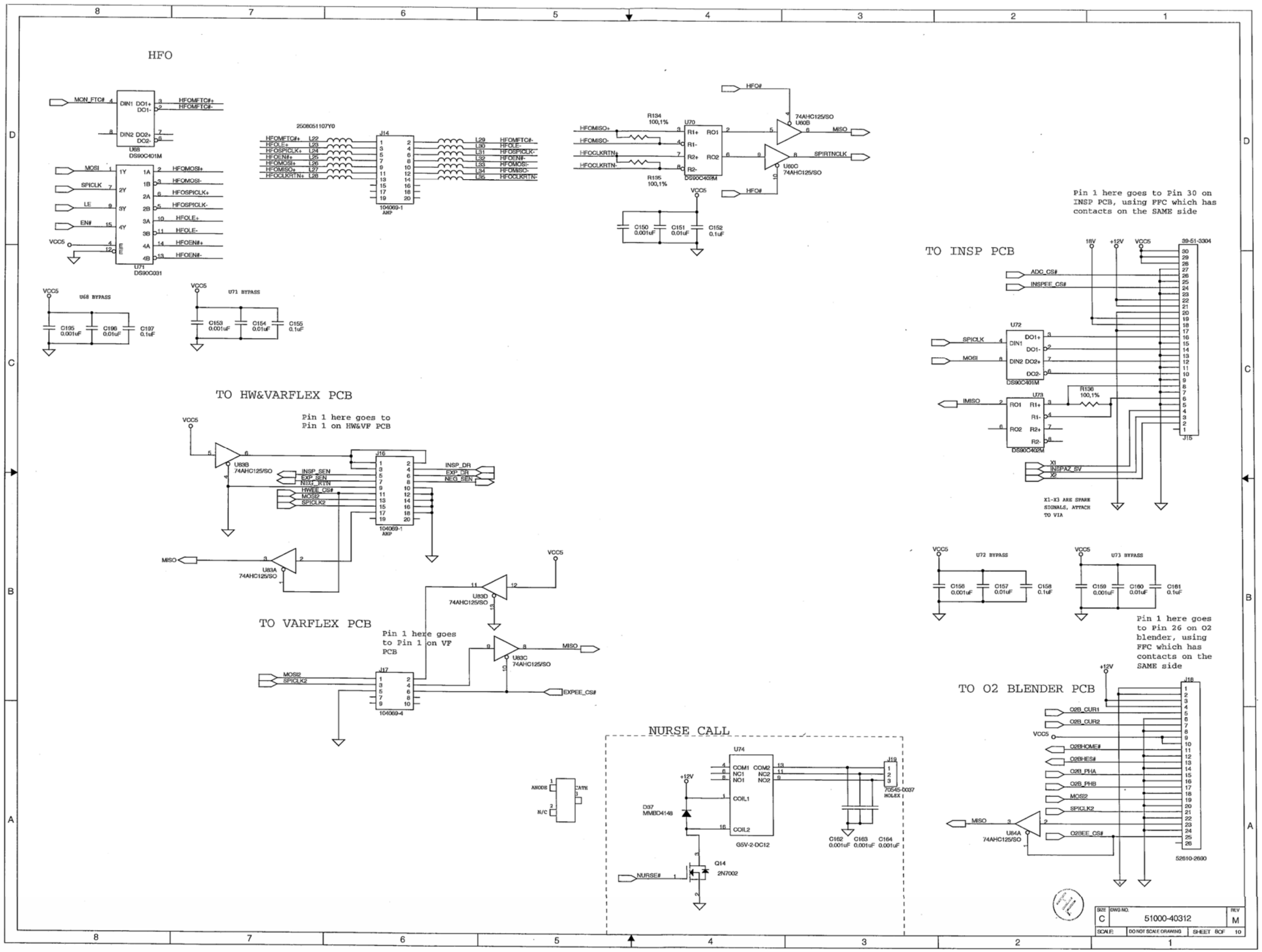
SIZE C
DWG NO. 51000-40312
REV M
SCALE:
DO NOT SCALE DRAWING
SHEET 6 OF 10

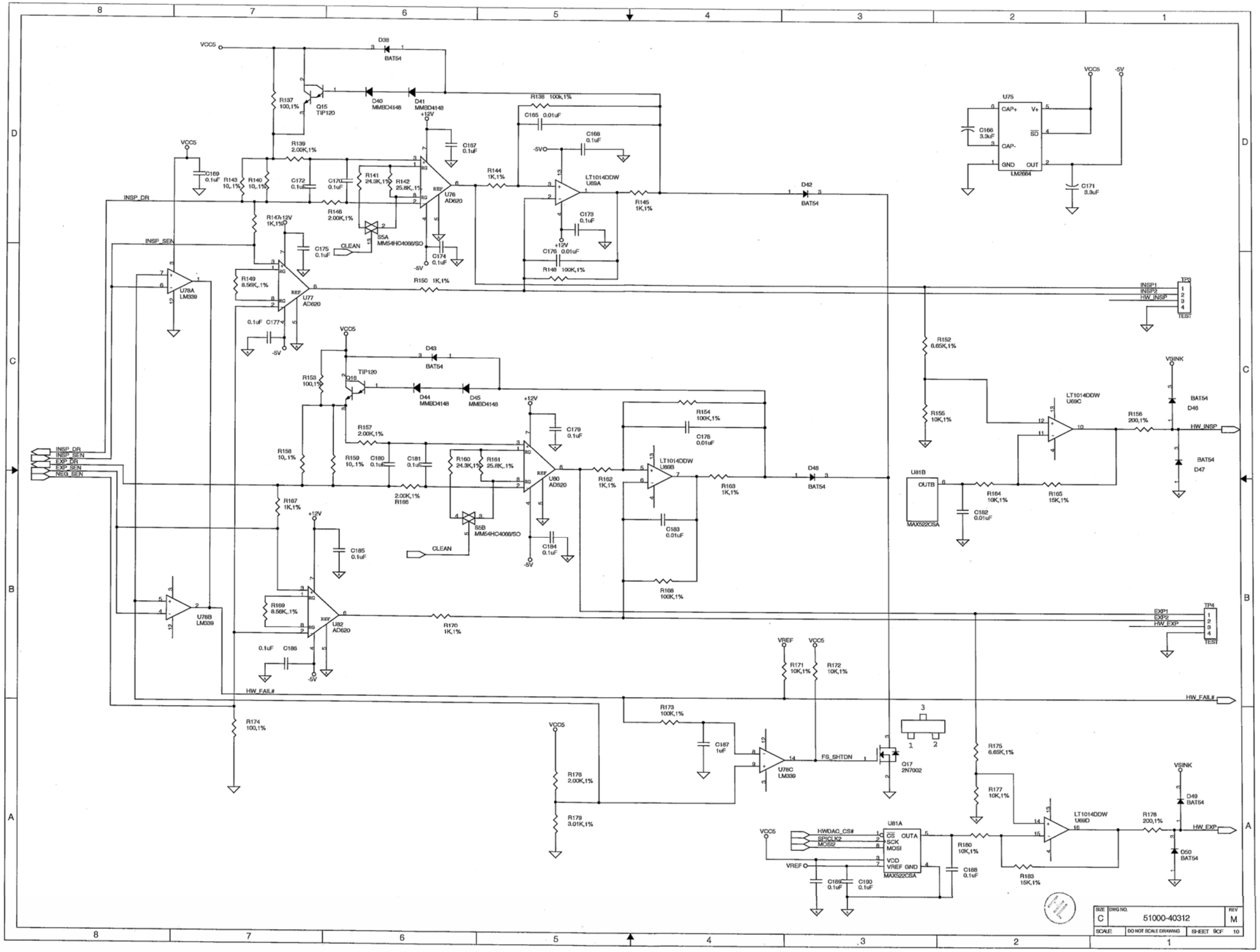


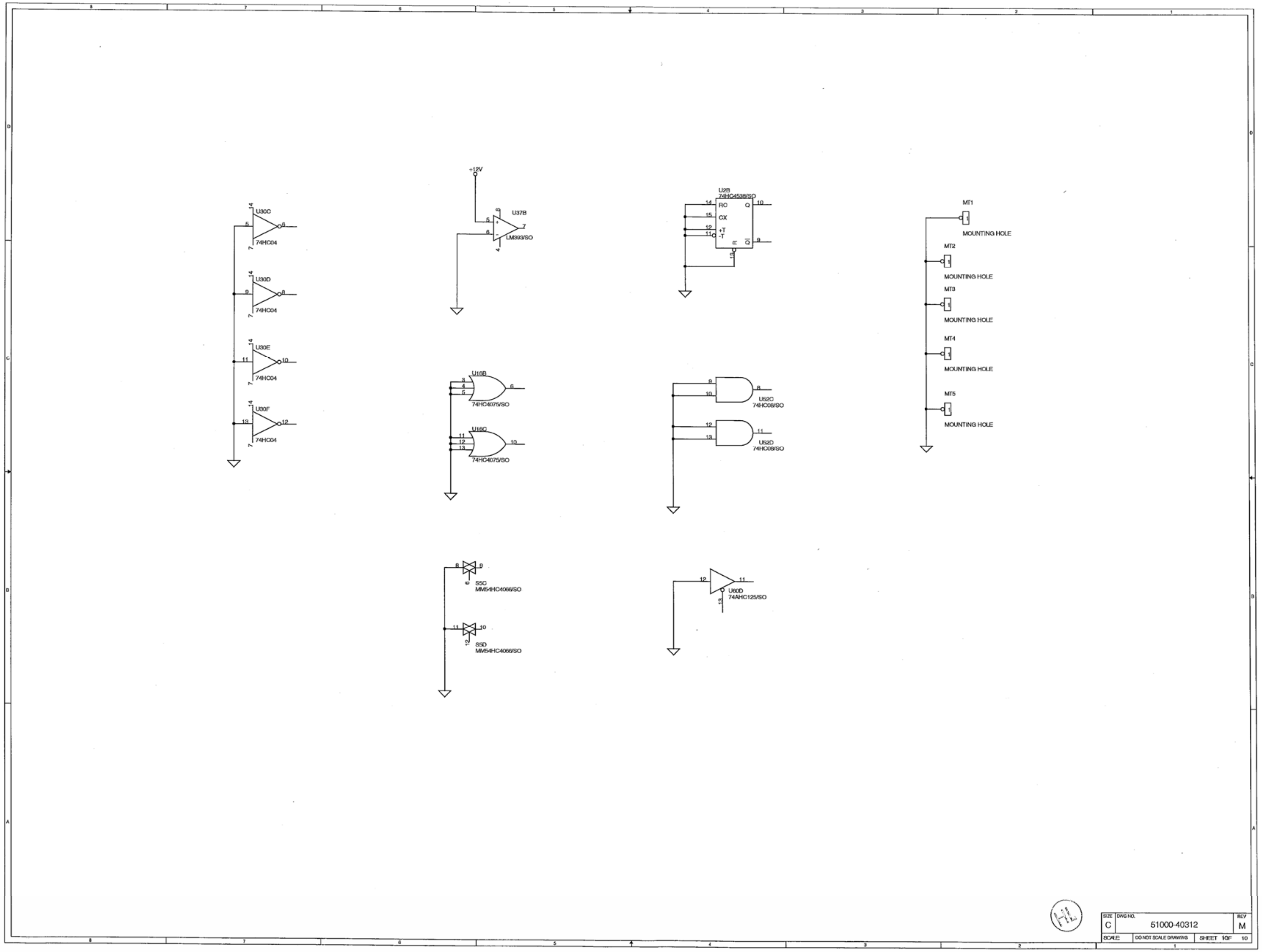
* U41,48,50,55,69 are OP492GS; U45 is TS924; U56 is LM348, the layouts for all of them were done using the LT1014 footprint.

Pin 1 here goes to Pin 80 on Pwr dvr

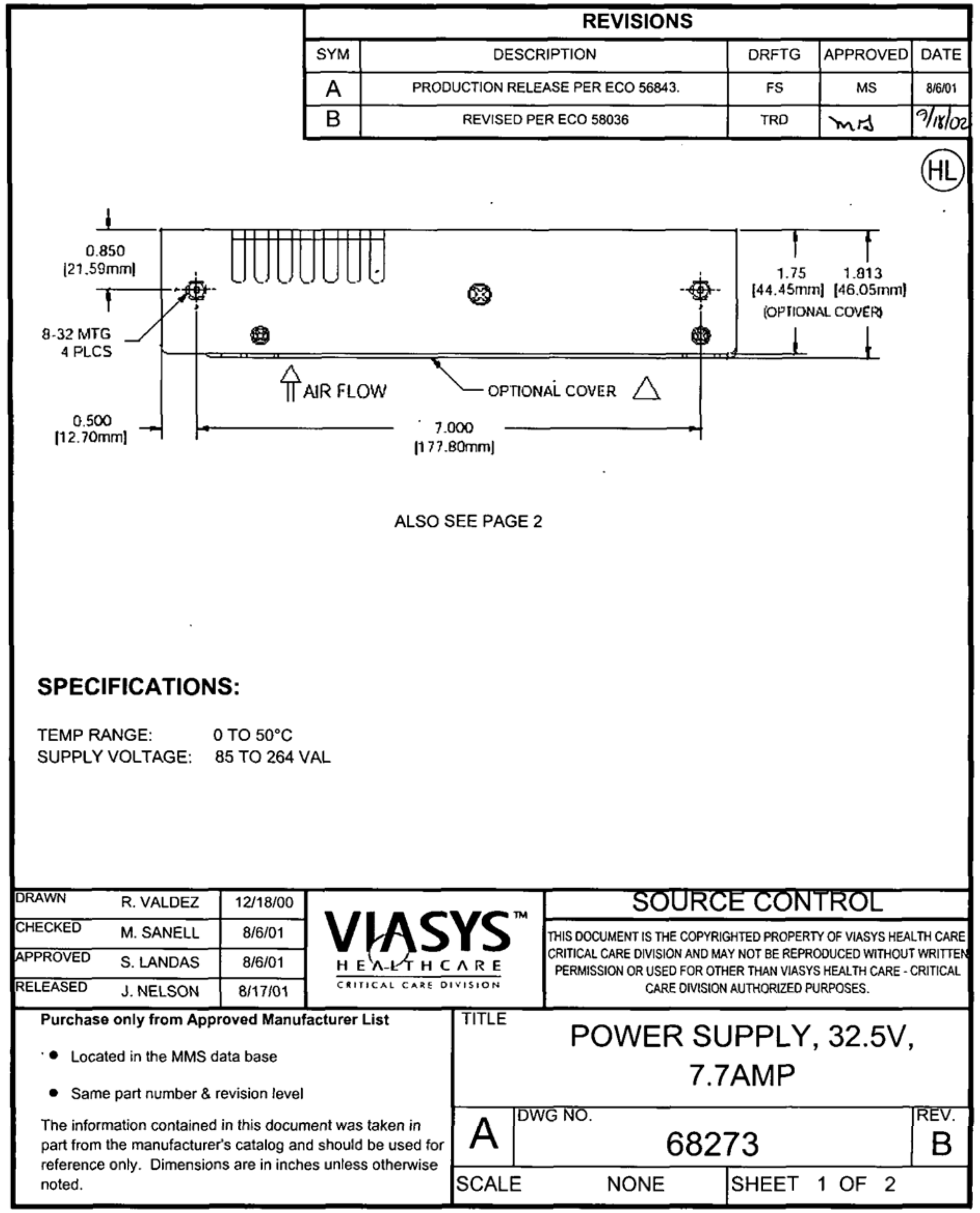
PWR/DRIVER PCB
HOUR METER
GAS ID
CURTIS 201HW HOUR METER
J10
70545-0007 MOLEX
HM_DATA
VREF
R127 10K,1%
D35 BZG048V2
D36 BZG048V2
J12
70545-0036
2508053017Z0
R130 10K,1%
GAS_ID
C138 0.001uF
C139 10uF
U57 NC7SZ58P6X
UIM_DISCON#
Q22 PMBT2222A
R105 1K,1%
R106 100,1%
R181 1K,1%
R182 10K,1%
J6
HFR050RA29NS1
THOMAS & BETTS
U59 DS90C401M
U60A 74AHC125/SO
SPICLK
MISO
VENT#
SPIRTNCLK
F1 2.5A SLO
28V
C111 0.001uF
C112 0.01uF
C113 0.1uF
U61 DS90C032
U62 DS90C402M
MON_FTC#
C110 0.1uF
BYPASS U62
C115 0.001uF
C116 0.01uF
C117 0.1uF
H5R25RA29C
THOMAS & BETTS
P1
2508052 7Y0
ANIN0
ANIN1
ANIN2
ANIN3
ANIN4
ANIN5
ANIN6
ANIN7
ILV_IN
ILV_OUT
12V_BUFFERED
PRESSURE
FLOW
VOLUME
PHASE
R116 100,1%
D62 BAV99
R117 100,1W
R119 100,1W
Q13 PMBT2222A
C114 0.1uF
U56A LM348
U63 PACDN002
C132 1uF
C118 2200pf
C119 2200pf
C120 2200pf
C121 2200pf
C122 2200pf
C123 2200pf
C124 2200pf
C125 2200pf
C126 2200pf
C127 2200pf
C128 2200pf
C129 2200pf
C130 2200pf
C131 2200pf
CON12
J8
J9
J11
BLNDGASEE_CS#
MISO
SPICLK2
MOSI2
BLNDGAS_PRESS
R121 10K,1%
R120 4.75K,1%
C133 1uF
AIREE_CS#
AIR_PRESS
R125 10K,1%
OXYEE_CS#
O2_PRESS
R128 10K,1%
VCC5
8.192V
C135 10uF
C136 0.1uF
C137 0.001uF
C134 0.1uF
R123 10K,1%
R124 10K,1%
U64A LM393/SO
INTBAT_STATUS
U64B LM393/SO
EXTBAT_STATUS
HEADER 40X2
JP1
U65 DS90C401M
U66 DS90C402M
U67 DS90C402M
DMISO
EMISO
O2_SV
XOVER_SV
NEB_SV
BOOST_SV
H2ODUMP_SV
DRVRSPARE_SV1
DRVRSPARE_SV2
DRVRSPARE_SV3
DRVRSPARE_SV4
HEATERON
HTRON_FDBK
DRVRDAC_CS#
DRVREE_CS#
ADC_CS#
FTC#
ADC_CS#
EPMEE_CS#
WESPURGE_SV
WESAZ_SV
TRACH_SV
ESOPVAC_SV
ESOPVACPUMP_SV
ESOPFILL_SV
EPMSPARE_SV1
EPMSPARE_SV2
SPKR+
SPKR-
COMPFANDAC_CS#
COMPEE_CS#
FCV_OVRCRT_PROT
FCVEE_CS#
AC_ON
WYEEE_CS#
VENT_OFF
FAN1_FAIL#
COMPR_FAIL#
EXTERNAL_TEMP
EXHAL_TEMP
OVRI_RST#
EXH_DRV
INTBATHDQ
EXTBATHDQ
C140 0.1uF
C141 10uF
C142 15uF, 50V
NOT POPULATED
C143 0.1uF
U65 BYPASS
U66 BYPASS
C147 0.001uF
C148 0.01uF
C149 0.1uF
C144 0.001uF
C145 0.01uF
C146 0.1uF
SIZE C
DWG NO. 51000-40312
REV M
SCALE
DO NOT SCALE DRAWING
SHEET 7 OF 10


HFO
MON_FTC#
DIN1 DO1+
DO1-
DIN2 DO2+
DO2-
U68
DS90C401M
HFOMFTC#+
HFOMFTC#-
MOSI
SPICLK
LE
EN#
VCC5
U71
DS90C031
HFOMOSI+
HFOMOSI-
HFOSPICLK+
HFOSPICLK-
HFOLE+
HFOLE-
HFOEN#+
HFOEN#-
2508051107Y0
J14
104069-1
AMP
L22
L23
L24
L25
L26
L27
L28
L29
L30
L31
L32
L33
L34
L35
HFOMISO+
HFOMISO-
HFOCLKRTN+
HFOCLKRTN-
HFOCLKRTN-
R134
100,1%
R135
100,1%
U70
DS90C402M
HFO#
74AHC125/SO
U60B
U60C
MISO
SPIRTNCLK
C150
0.001uF
C151
0.01uF
C152
0.1uF
U68 BYPASS
C195
0.001uF
C196
0.01uF
C197
0.1uF
U71 BYPASS
C153
0.001uF
C154
0.01uF
C155
0.1uF
TO HW&VARFLEX PCB
Pin 1 here goes to Pin 1 on HW&VF PCB
U83B
74AHC125/SO
J16
INSP_SEN
EXP_SEN
NEG_RTN
HWEE_CS#
MOSI2
SPICLK2
INSP_DR
EXP_DR
NEG_SEN
U83A
74AHC125/SO
U83D
74AHC125/SO
U83C
74AHC125/SO
TO VARFLEX PCB
Pin 1 here goes to Pin 1 on VF PCB
J17
104069-4
EXPEE_CS#
Pin 1 here goes to Pin 30 on INSP PCB, using FFC which has contacts on the SAME side
TO INSP PCB
18V
+12V
39-51-3304
ADC_CS#
INSPEE_CS#
U72
DS90C401M
U73
DS90C402M
R136
100,1%
IMISO
X1
INSPAZ_SV
X2
J15
X1-X3 ARE SPARE SIGNALS, ATTACH TO VIA
U72 BYPASS
C156
0.001uF
C157
0.01uF
C158
0.1uF
U73 BYPASS
C159
0.001uF
C160
0.01uF
C161
0.1uF
Pin 1 here goes to Pin 26 on O2 blender, using FFC which has contacts on the SAME side
TO O2 BLENDER PCB
J18
O2B_CUR1
O2B_CUR2
O2BHOME#
O2BHES#
O2B_PHA
O2B_PHB
MOSI2
SPICLK2
U84A
74AHC125/SO
O2BEE_CS#
52610-2690
NURSE CALL
U74
COM1
COM2
NC1
NC2
NO1
NO2
COIL1
COIL2
G5V-2-DC12
D37
MMBD4148
J19
70545-0037
MOLEX
C162
0.001uF
C163
0.001uF
C164
0.001uF
Q14
2N7002
NURSE#
ANODE
CATH
N/C
SIZE
C
DWG NO.
51000-40312
REV
M
SCALE
DO NOT SCALE DRAWING
SHEET 8 OF 10


VCC5
D38
BAT54
R137
100,1%
Q15
TIP120
D40
MMBD4148
D41
MMBD4148
+12V
R138 100k,1%
C165 0.01uF
C168
0.1uF
-5V
C167
0.1uF
R139
2.00K,1%
C169
0.1uF
R143
10,.1%
R140
10,.1%
C172
0.1uF
C170
0.1uF
R141
24.3K,1%
R142
25.8K,.1%
U76
AD620
R144
1K,1%
LT1014DDW
U69A
R145
1K,1%
D42
BAT54
C173
0.1uF
C176 0.01uF
R148 100K,1%
INSP_DR
INSP_SEN
R147
1K,1%
R146
2.00K,1%
S5A
MM54HC4066/SO
CLEAN
C175
0.1uF
C174
0.1uF
U78A
LM339
R149
8.56K,.1%
U77
AD620
R150 1K,1%
0.1uF C177
U75
CAP+
V+
C166
3.3uF
SD
CAP-
GND
OUT
LM2664
C171
3.3uF
INSP1
INSP2
HW_INSP
TP3
TEST
R152
6.65K,1%
VSINK
D43
BAT54
R153
100,1%
Q16
TIP120
D44
MMBD4148
D45
MMBD4148
R154
100K,1%
C178
0.01uF
C179
0.1uF
R157
2.00K,1%
R158
10,.1%
R159
10,.1%
C180
0.1uF
C181
0.1uF
R160
24.3K,1%
R161
25.8K,.1%
U80
AD620
LT1014DDW
U69B
R162
1K,1%
R163
1K,1%
D48
BAT54
U81B
OUTB
MAX522CSA
R155
10K,1%
LT1014DDW
U69C
R156
200,1%
D46
BAT54
HW_INSP
D47
BAT54
R164
10K,1%
R165
15K,1%
C182
0.01uF
INSP_DR
INSP_SEN
EXP_DR
EXP_SEN
NEG_SEN
2.00K,1%
R166
R167
1K,1%
S5B
MM54HC4066/SO
CLEAN
C183
0.01uF
C184
0.1uF
C185
0.1uF
U78B
LM339
R169
8.56K,.1%
U82
AD620
R170
1K,1%
R168
100K,1%
0.1uF C186
EXP1
EXP2
HW_EXP
TP4
TEST
VREF
VCC5
R171
10K,1%
R172
10K,1%
HW_FAIL#
HW_FAIL#
R173
100K,1%
R174
100,1%
VCC5
C187
1uF
U78C
LM339
FS_SHTDN
Q17
2N7002
R175
6.65K,1%
R176
2.00K,1%
R179
3.01K,1%
R177
10K,1%
VSINK
D49
BAT54
LT1014DDW
U69D
R178
200,1%
HW_EXP
D50
BAT54
U81A
HWDAC_CS#
SPICLK2
MOSI2
CS
SCK
MOSI
OUTA
VDD
VREF
GND
MAX522CSA
R180
10K,1%
R183
15K,1%
C188
0.1uF
C189
0.1uF
C190
0.1uF
SIZE
C
DWG NO.
51000-40312
REV
M
SCALE
DO NOT SCALE DRAWING
SHEET 9 OF 10
8
7
6
5
4
3
2
1
D
C
B
A


U30C
74HC04
U30D
74HC04
U30E
74HC04
U30F
74HC04
+12V
U37B
LM393/SO
U16B
74HC4075/SO
U16C
74HC4075/SO
U2B
74HC4538/SO
RC
CX
+T
-T
R
Q
Q̄
U52C
74HC08/SO
U52D
74HC08/SO
S5C
MM54HC4066/SO
S5D
MM54HC4066/SO
U60D
74AHC125/SO
MT1
MOUNTING HOLE
MT2
MOUNTING HOLE
MT3
MOUNTING HOLE
MT4
MOUNTING HOLE
MT5
MOUNTING HOLE
SIZE
C
DWG NO.
51000-40312
REV
M
SCALE
DO NOT SCALE DRAWING
SHEET 10F 10

Power Supply



HL
0.850
[21.59mm]
8-32 MTG
4 PLCS
1.75
[44.45mm]
1.813
[46.05mm]
(OPTIONAL COVER)
AIR FLOW
OPTIONAL COVER
0.500
[12.70mm]
7.000
[177.80mm]

REVISIONS				
SYM	DESCRIPTION	DRFTG	APPROVED	DATE
A	PRODUCTION RELEASE PER ECO 56843.	FS	MS	8/6/01
B	REVISED PER ECO 58036	TRD	ms	9/18/02

ALSO SEE PAGE 2

SPECIFICATIONS:

TEMP RANGE: 0 TO 50°C
SUPPLY VOLTAGE: 85 TO 264 VAL

DRAWN	R. VALDEZ	12/18/00
CHECKED	M. SANELL	8/6/01
APPROVED	S. LANDAS	8/6/01
RELEASED	J. NELSON	8/17/01

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CRITICAL CARE DIVISION

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Purchase only from Approved Manufacturer List

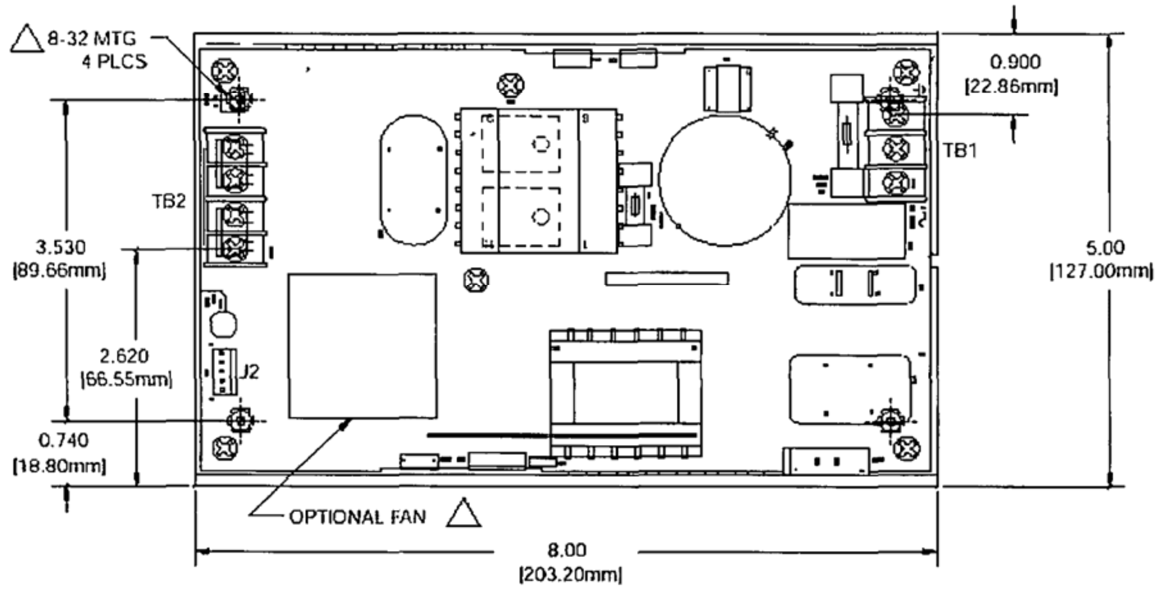
- Located in the MMS data base
- Same part number & revision level

The information contained in this document was taken in part from the manufacturer's catalog and should be used for reference only. Dimensions are in inches unless otherwise noted.

TITLE
POWER SUPPLY, 32.5V,
7.7AMP

A DWG NO. 68273 REV. B

SCALE NONE SHEET 1 OF 2


8-32 MTG
4 PLCS
TB2
TB1
J2
0.900
[22.86mm]
5.00
[127.00mm]
3.530
[89.66mm]
2.620
[66.55mm]
0.740
[18.80mm]
OPTIONAL FAN
8.00
[203.20mm]

INPUT:

TB1
- 6-32, 3 PIN TERMINAL BLOCK
- PIN 1) AC LINE
- PIN 2) AC NEUTRAL
- PIN 3) AC GROUND

SIGNALS:J2
- AMP P.C.B. HEADER P/N 640456-5
- MATING CONNECTOR P/N 640621-5
- PIN 1) DC GOOD
- PIN 2) POWER FAIL
- PIN 3) EXT OFF
- PIN 4) +SENSE
- PIN 5) -SENSE

FAN
- AMP P.C.B. HEADER P/N 640456-2
- MATING CONNECTOR P/N 640621-2
- PIN 1) -
- PIN 2) +

OUTPUT:

TB2
- 6-32, 4 PIN TERMINAL BLOCK 0.375 [9.53mm] CTR
- BUS BAR WITH 10-32 SCREW ON HIGH-CURRENT MODELS.
- PINS 1-2) +Vout
- PINS 3-4) RETURN

16A MAXIMUM RECOMMENDED CURRENT PER CONNECTOR PIN.

MAX. SCREW PROTRUSION ABOVE CHASSIS = 0.120" [3.05mm].

OPTIONAL COVER/FAN ASSEMBLY AVAILABLE.

WEIGHT: 2.9 LBS [1.32kg] MAX.

TOLERANCES: X.XX=0.030 [0.76mm]
X.XXX=0.010 [0.25mm]

VIASYS™
HEALTHCARE
CRITICAL CARE DIVISION

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A	DWG NO. 68273	REV B
	SHEET 2 OF 2	

PCBA, Exhalation Flow Transition

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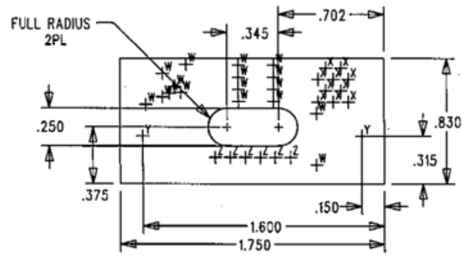
REVISION HISTORY					
REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	56689	PILOT RELEASE PER ECO	RJH	MVN	7.23.01
A	57362	PROD RELEASE PER ECO	RJH		1·3·02

UNLESS OTHERWISE SPECIFIED

1. FABRICATE BOARD USING ARTWORK 51000-40433 REV A.
2. BOARD VIEWED FROM PRIMARY SIDE.
3. MATERIAL: BOARD TO BE COMPOSED OF 4 CIRCUIT LAYERS OF COPPER CLAD/PLATED (HTE PER IPC-C-150) "GFN" GLASS-EPOXY LAMINATES PER M-S-13949 (POLYFUNCTIONAL WITH LOW RESIN CONTENT PREPREG PREFERRED) OVERALL BOARD THICKNESS TO BE 0.062 +/- 0.005
4. DIELECTRIC THICKNESS BETWEEN CIRCUIT LAYERS SHALL BE AS FOLLOWS:
   BETWEEN LAYERS 1 AND 2 ---- NO LESS THAN 0.018
   BETWEEN LAYERS 2 AND 3 ---- NO LESS THAN 0.018
   BETWEEN LAYERS 3 AND 4 ---- NO LESS THAN 0.018
5. ALL HOLES TO BE PLATED THRU TO HAVE 0.0002 - 0.0007 POSITIVE ETCHBACK ON HOLES PRIOR TO PLATING. ELONGATION PROPERTY OF 10% ON ALL PLATED COPPER. HOLE DIAMETER TOLERANCE TO BE +/- 0.003 AFTER PLATING.
6. NON-PLATED HOLES MAY BE USED AS TOOLING POINTS.
7. BOARD SUPPLIER'S NAME, TRADEMARK, U.L. RECOGNITION CODE AND TYPE DESIGNATION TO BE ETCHED ONTO SECONDARY SIDE OF BOARD.
8. MINIMUM CONDUCTOR WIDTH 0.006
   MINIMUM CONDUCTOR SPACING 0.006
9. COPPER CIRCUITRY THICKNESS SHALL BE PLATED UP TO THE FOLLOWING DIMENSIONS:
   OUTER LAYERS ------------------ 0.0014 MIN
   INNER LAYERS (ETCHED) ------------ 0.0014 MIN
   PLATED THRU HOLES -------------- 0.0014 MIN
10. WARP OR TWIST OF BOARD SHALL NOT EXCEED 0.010 PER INCH.
11. APPLY GREEN LPI SOLDER MASK CONFORMING TO IPC-SM-840, CLASS 2, OVER BARE COPPER, ONTO BOTH SIDES OF BOARD USING APPROPRIATE ARTWORK.
12. EXPOSED CIRCUITRY TO BE SOLDER COATED AND HOT-AIR SOLDER LEVELED.
13. SILKSCREEN LEGEND ONTO PRIMARY SIDE OF BOARD USING WHITE, EPOXY BASED PAINT OR INK AND APPROPRIATE ARTWORK.
14. BOARD TO BE FREE OF FRAYED OR SHARP EDGES AND ALL TRIM LINES ARE TO BE REMOVED.
15. ACCEPTANCE CRITERIA SHALL BE AS DEFINED IN IPC-A-600, CLASS 2, FOR TYPE 3 PRINTED BOARDS.
16. THE FINISHED BOARD SHALL COMPLY WITH U.L. STANDARD 796 AND HAVE A FLAMMABILITY RATING OF 94V-0 OR BETTER.
17. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 51000-40430.



SIZE	QTY	SYM	PLTD
15	17	W	PLTD
31	10	X	PLTD
145	2	Y	PLTD
35	6	Z	PLTD

QLT REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◁— DASH NO.	PART LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES:
.X ± .1 .XXX ± .005
.XX ± .02 ANG ± 1.00°
C. MACH SURFACES $\sqrt{}$ 63 OR BETTER.
D. CORNER FILLETS & RADII .005-.010.
E. DEBURR EDGES .005-.020.
F. CHAMFER FIRST & LAST THREAD 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	R.J. HALES	6.13.01
CHECKED	MV NORTH	6.15.01
APPROVED	S LANDAS	7.13.01
RELEASED	H LACY	7.23.01

VIASYS™ HEALTHCARE
CRITICAL CARE DIVISION

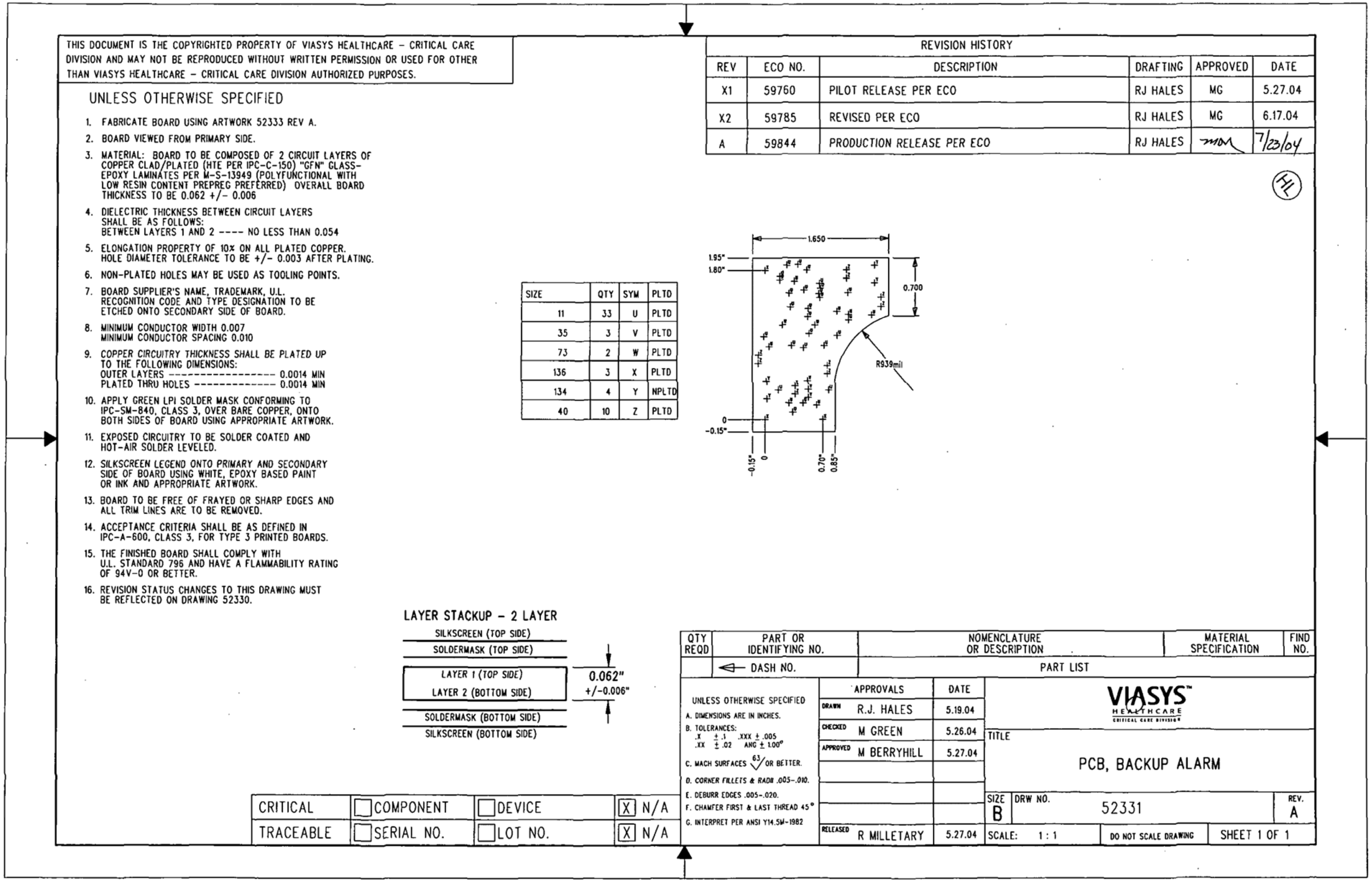
TITLE
PCB, EXHALATION FLOW TRANSITION

SIZE B
DRW NO. 51000-40431
REV. A
SCALE: 1 : 1
DO NOT SCALE DRAWING
SHEET 1 OF 1

BIDS

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

PCBA, Backup Alarm



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UNLESS OTHERWISE SPECIFIED

1. FABRICATE BOARD USING ARTWORK 52333 REV A.
2. BOARD VIEWED FROM PRIMARY SIDE.
3. MATERIAL: BOARD TO BE COMPOSED OF 2 CIRCUIT LAYERS OF COPPER CLAD/PLATED (HTE PER IPC-C-150) "GFN" GLASS-EPOXY LAMINATES PER M-S-13949 (POLYFUNCTIONAL WITH LOW RESIN CONTENT PREPREG PREFERRED) OVERALL BOARD THICKNESS TO BE 0.062 +/- 0.006
4. DIELECTRIC THICKNESS BETWEEN CIRCUIT LAYERS SHALL BE AS FOLLOWS:
   BETWEEN LAYERS 1 AND 2 ---- NO LESS THAN 0.054
5. ELONGATION PROPERTY OF 10% ON ALL PLATED COPPER. HOLE DIAMETER TOLERANCE TO BE +/- 0.003 AFTER PLATING.
6. NON-PLATED HOLES MAY BE USED AS TOOLING POINTS.
7. BOARD SUPPLIER'S NAME, TRADEMARK, U.L. RECOGNITION CODE AND TYPE DESIGNATION TO BE ETCHED ONTO SECONDARY SIDE OF BOARD.
8. MINIMUM CONDUCTOR WIDTH 0.007
   MINIMUM CONDUCTOR SPACING 0.010
9. COPPER CIRCUITRY THICKNESS SHALL BE PLATED UP TO THE FOLLOWING DIMENSIONS:
   OUTER LAYERS ------------------ 0.0014 MIN
   PLATED THRU HOLES ------------- 0.0014 MIN
10. APPLY GREEN LPI SOLDER MASK CONFORMING TO IPC-SM-840, CLASS 3, OVER BARE COPPER, ONTO BOTH SIDES OF BOARD USING APPROPRIATE ARTWORK.
11. EXPOSED CIRCUITRY TO BE SOLDER COATED AND HOT-AIR SOLDER LEVELED.
12. SILKSCREEN LEGEND ONTO PRIMARY AND SECONDARY SIDE OF BOARD USING WHITE, EPOXY BASED PAINT OR INK AND APPROPRIATE ARTWORK.
13. BOARD TO BE FREE OF FRAYED OR SHARP EDGES AND ALL TRIM LINES ARE TO BE REMOVED.
14. ACCEPTANCE CRITERIA SHALL BE AS DEFINED IN IPC-A-600, CLASS 3, FOR TYPE 3 PRINTED BOARDS.
15. THE FINISHED BOARD SHALL COMPLY WITH U.L. STANDARD 796 AND HAVE A FLAMMABILITY RATING OF 94V-0 OR BETTER.
16. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 52330.

SIZE	QTY	SYM	PLTD
11	33	U	PLTD
35	3	V	PLTD
73	2	W	PLTD
136	3	X	PLTD
134	4	Y	NPLTD
40	10	Z	PLTD

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	59760	PILOT RELEASE PER ECO	RJ HALES	MG	5.27.04
X2	59785	REVISED PER ECO	RJ HALES	MG	6.17.04
A	59844	PRODUCTION RELEASE PER ECO	RJ HALES		7/23/04

LAYER STACKUP – 2 LAYER

SILKSCREEN (TOP SIDE)
SOLDERMASK (TOP SIDE)
LAYER 1 (TOP SIDE)
LAYER 2 (BOTTOM SIDE)
SOLDERMASK (BOTTOM SIDE)
SILKSCREEN (BOTTOM SIDE)

0.062"
+/-0.006"

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	FIND NO.
	◁— DASH NO.	PART LIST		

UNLESS OTHERWISE SPECIFIED
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES:
.X ± .1 .XXX ± .005
.XX ± .02 ANG ± 1.00°
C. MACH SURFACES $\sqrt{63}$ OR BETTER.
D. CORNER FILLETS & RADII .005-.010.
E. DEBURR EDGES .005-.020.
F. CHAMFER FIRST & LAST THREAD 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	R.J. HALES	5.19.04
CHECKED	M GREEN	5.26.04
APPROVED	M BERRYHILL	5.27.04
RELEASED	R MILLETARY	5.27.04

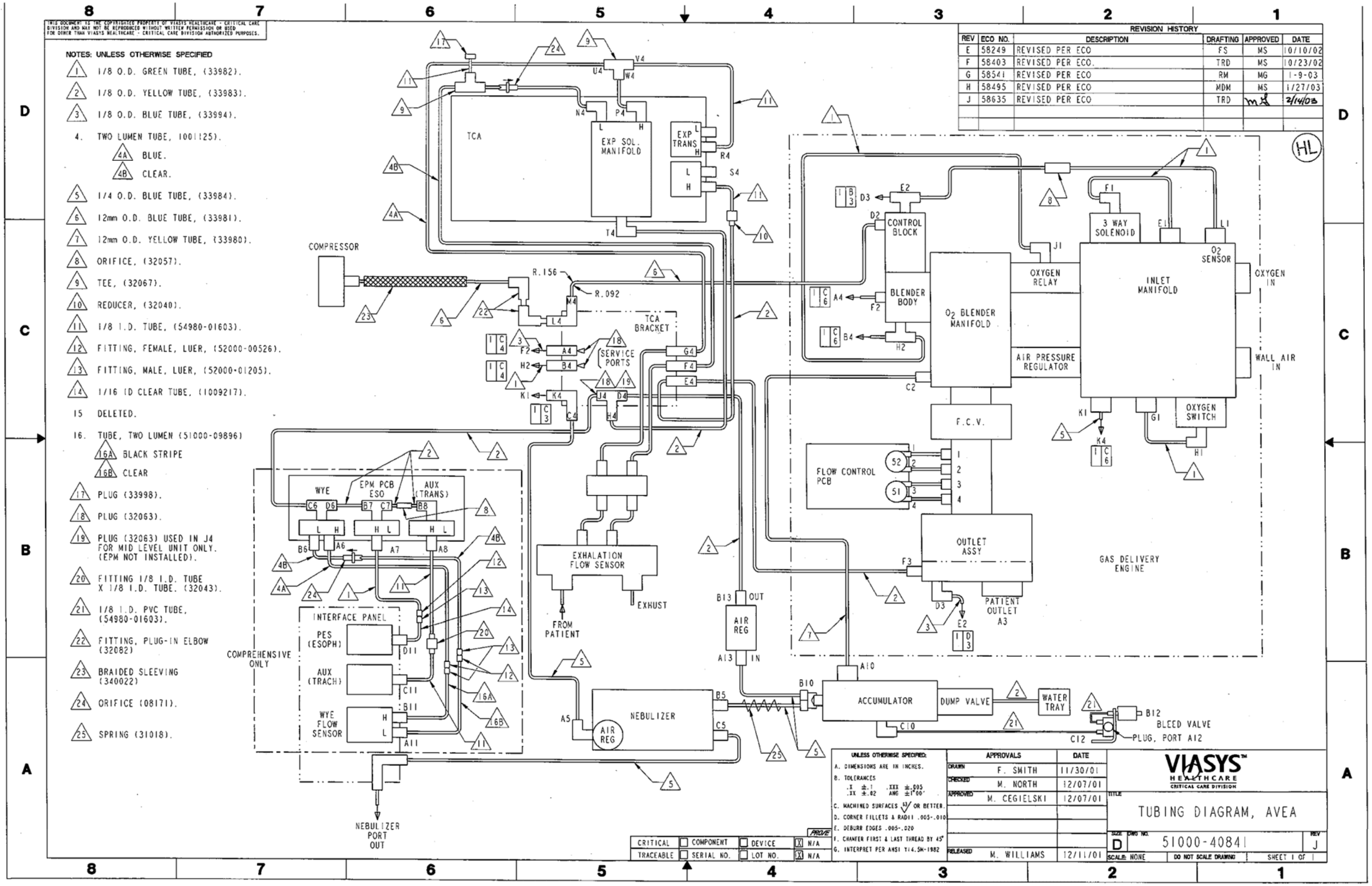
VIASYS™ HEALTHCARE CRITICAL CARE DIVISION

TITLE
PCB, BACKUP ALARM

SIZE B
DRW NO. 52331
REV. A
SCALE: 1 : 1
DO NOT SCALE DRAWING
SHEET 1 OF 1

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

Tubing Diagram


TCA
EXP SOL. MANIFOLD
EXP TRANS
COMPRESSOR
R.156
R.092
TCA BRACKET
SERVICE PORTS
CONTROL BLOCK
BLENDER BODY
O2 BLENDER MANIFOLD
OXYGEN RELAY
AIR PRESSURE REGULATOR
3 WAY SOLENOID
INLET MANIFOLD
O2 SENSOR
OXYGEN IN
WALL AIR IN
OXYGEN SWITCH
F.C.V.
FLOW CONTROL PCB
OUTLET ASSY
GAS DELIVERY ENGINE
PATIENT OUTLET A3
WYE
EPM PCB ESO
AUX (TRANS)
INTERFACE PANEL
PES (ESOPH)
AUX (TRACH)
WYE FLOW SENSOR
COMPREHENSIVE ONLY
EXHALATION FLOW SENSOR
FROM PATIENT
EXHUST
AIR REG
NEBULIZER
ACCUMULATOR
DUMP VALVE
WATER TRAY
B12 BLEED VALVE
PLUG, PORT A12
NEBULIZER PORT OUT
HL

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NOTES: UNLESS OTHERWISE SPECIFIED

1 1/8 O.D. GREEN TUBE, (33982).
2 1/8 O.D. YELLOW TUBE, (33983).
3 1/8 O.D. BLUE TUBE, (33994).
4. TWO LUMEN TUBE, 1001125).
  4A BLUE.
  4B CLEAR.
5 1/4 O.D. BLUE TUBE, (33984).
6 12mm O.D. BLUE TUBE, (33981).
7 12mm O.D. YELLOW TUBE, (33980).
8 ORIFICE, (32057).
9 TEE, (32067).
10 REDUCER, (32040).
11 1/8 I.D. TUBE, (54980-01603).
12 FITTING, FEMALE, LUER, (52000-00526).
13 FITTING, MALE, LUER, (52000-01205).
14 1/16 ID CLEAR TUBE, (1009217).
15 DELETED.
16. TUBE, TWO LUMEN (51000-09896)
  16A BLACK STRIPE
  16B CLEAR
17 PLUG (33998).
18 PLUG (32063).
19 PLUG (32063) USED IN J4 FOR MID LEVEL UNIT ONLY. (EPM NOT INSTALLED).
20 FITTING 1/8 I.D. TUBE X 1/8 I.D. TUBE. (32043).
21 1/8 I.D. PVC TUBE, (54980-01603).
22 FITTING, PLUG-IN ELBOW (32082)
23 BRAIDED SLEEVING (340022)
24 ORIFICE (08171).
25 SPRING (31018).

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
E	58249	REVISED PER ECO	FS	MS	10/10/02
F	58403	REVISED PER ECO.	TRD	MS	10/23/02
G	58541	REVISED PER ECO	RM	MG	1-9-03
H	58495	REVISED PER ECO	MDM	MS	1/27/03
J	58635	REVISED PER ECO	TRD	mL	2/14/03

UNLESS OTHERWISE SPECIFIED:
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES .X ±.1 .XX ±.02 .XXX ±.005 ANG ±1°00'
C. MACHINED SURFACES 63 OR BETTER.
D. CORNER FILLETS & RADII .005-.010
E. DEBURR EDGES .005-.020
F. CHAMFER FIRST & LAST THREAD BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

APPROVALS		DATE
DRAWN	F. SMITH	11/30/01
CHECKED	M. NORTH	12/07/01
APPROVED	M. CEGIELSKI	12/07/01
RELEASED	M. WILLIAMS	12/11/01

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A		
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A		

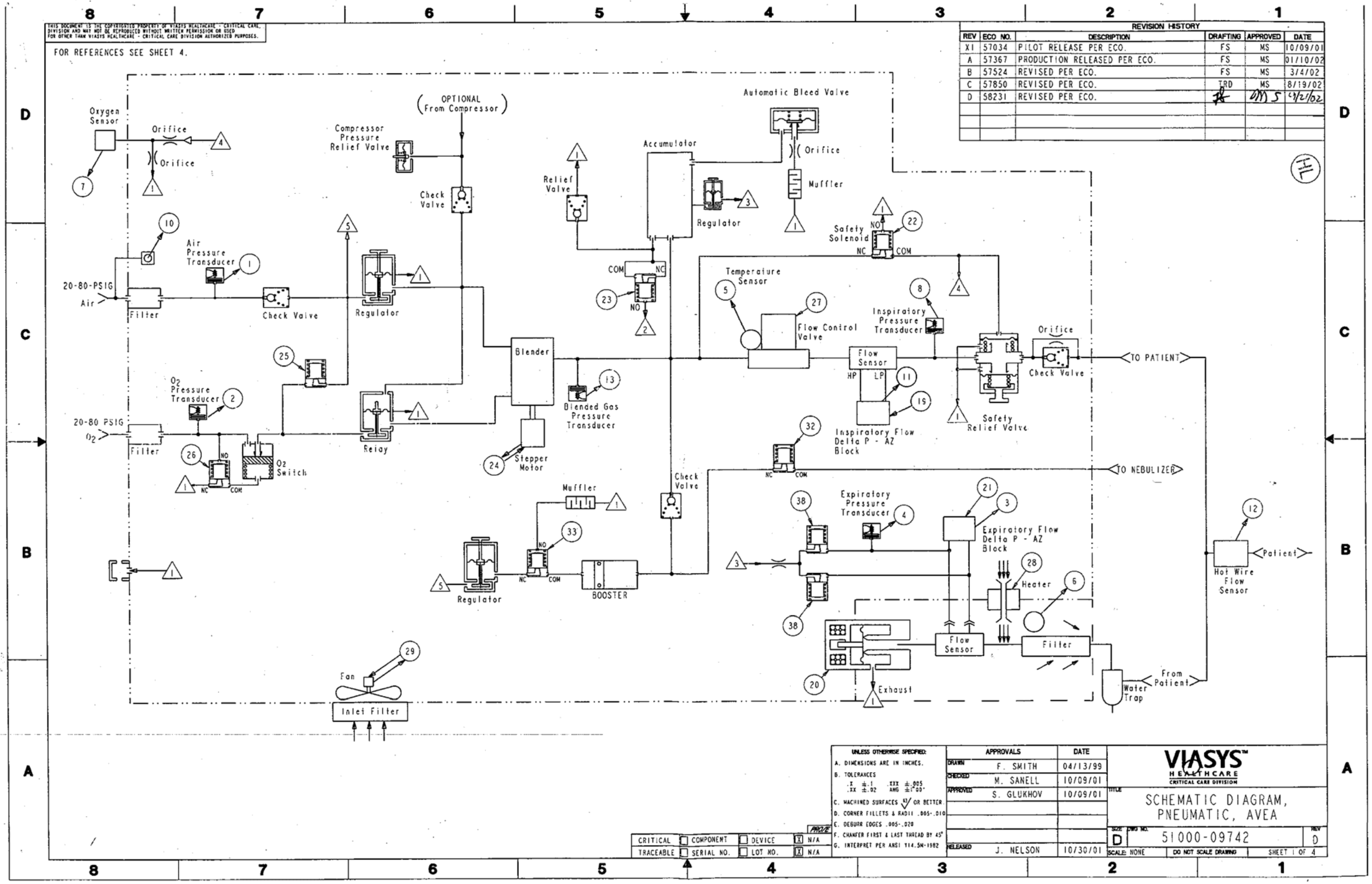
VIASYS™ HEALTHCARE CRITICAL CARE DIVISION

TITLE TUBING DIAGRAM, AVEA

SIZE D DWG NO. 51000-40841 REV J

SCALE: NONE DO NOT SCALE DRAWING SHEET 1 OF 1

Pneumatic Diagram


8
7
6
5
4
3
2
1
D
C
B
A
Oxygen Sensor
Orifice
Orifice
7
4
1
OPTIONAL From Compressor
Compressor Pressure Relief Valve
Check Valve
5
Automatic Bleed Valve
Orifice
Muffler
1
Accumulator
Relief Valve
1
Regulator
3
Safety Solenoid
NO
NC
COM
22
1
4
10
Air Pressure Transducer
1
20-80-PSIG Air
Filter
Check Valve
Regulator
1
COM
NC
23
NO
2
Temperature Sensor
5
27
Flow Control Valve
8
Inspiratory Pressure Transducer
Orifice
Check Valve
TO PATIENT
Blender
Flow Sensor
HP
LP
11
19
Inspiratory Flow Delta P - AZ Block
Safety Relief Valve
1
25
O2 Pressure Transducer
2
20-80 PSIG O2
Filter
26
NO
NC
COM
1
O2 Switch
Relay
1
13
Blended Gas Pressure Transducer
24
Stepper Motor
32
NC
COM
TO NEBULIZER
Check Valve
Muffler
1
33
NO
NC
COM
5
Regulator
BOOSTER
38
Expiratory Pressure Transducer
4
21
3
Expiratory Flow Delta P - AZ Block
3
28
Heater
6
38
Flow Sensor
Filter
20
Exhaust
1
12
Patient
Hot Wire Flow Sensor
From Patient
Water Trap
1
29
Fan
Inlet Filter
HL

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FOR REFERENCES SEE SHEET 4.

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
XI	57034	PILOT RELEASE PER ECO.	FS	MS	10/09/01
A	57367	PRODUCTION RELEASED PER ECO.	FS	MS	01/10/02
B	57524	REVISED PER ECO.	FS	MS	3/4/02
C	57850	REVISED PER ECO.	TRD	MS	8/19/02
D	58231	REVISED PER ECO.		MS	9/21/02

UNLESS OTHERWISE SPECIFIED:
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.02 ANG ±1°00'
C. MACHINED SURFACES 63 OR BETTER.
D. CORNER FILLETS & RADII .005-.010
E. DEBURR EDGES .005-.020
F. CHAMFER FIRST & LAST THREAD BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

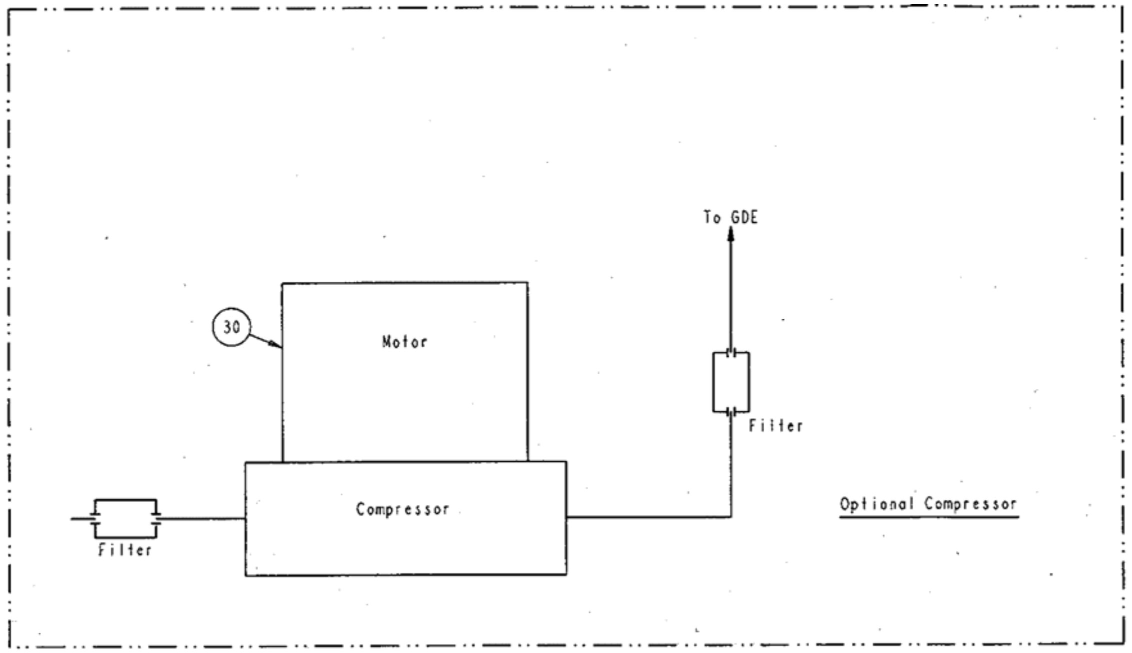
	APPROVALS	DATE
DRAWN	F. SMITH	04/13/99
CHECKED	M. SANELL	10/09/01
APPROVED	S. GLUKHOV	10/09/01
RELEASED	J. NELSON	10/30/01

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A	PROVE
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A	

VIASYS™
HEALTHCARE
CRITICAL CARE DIVISION

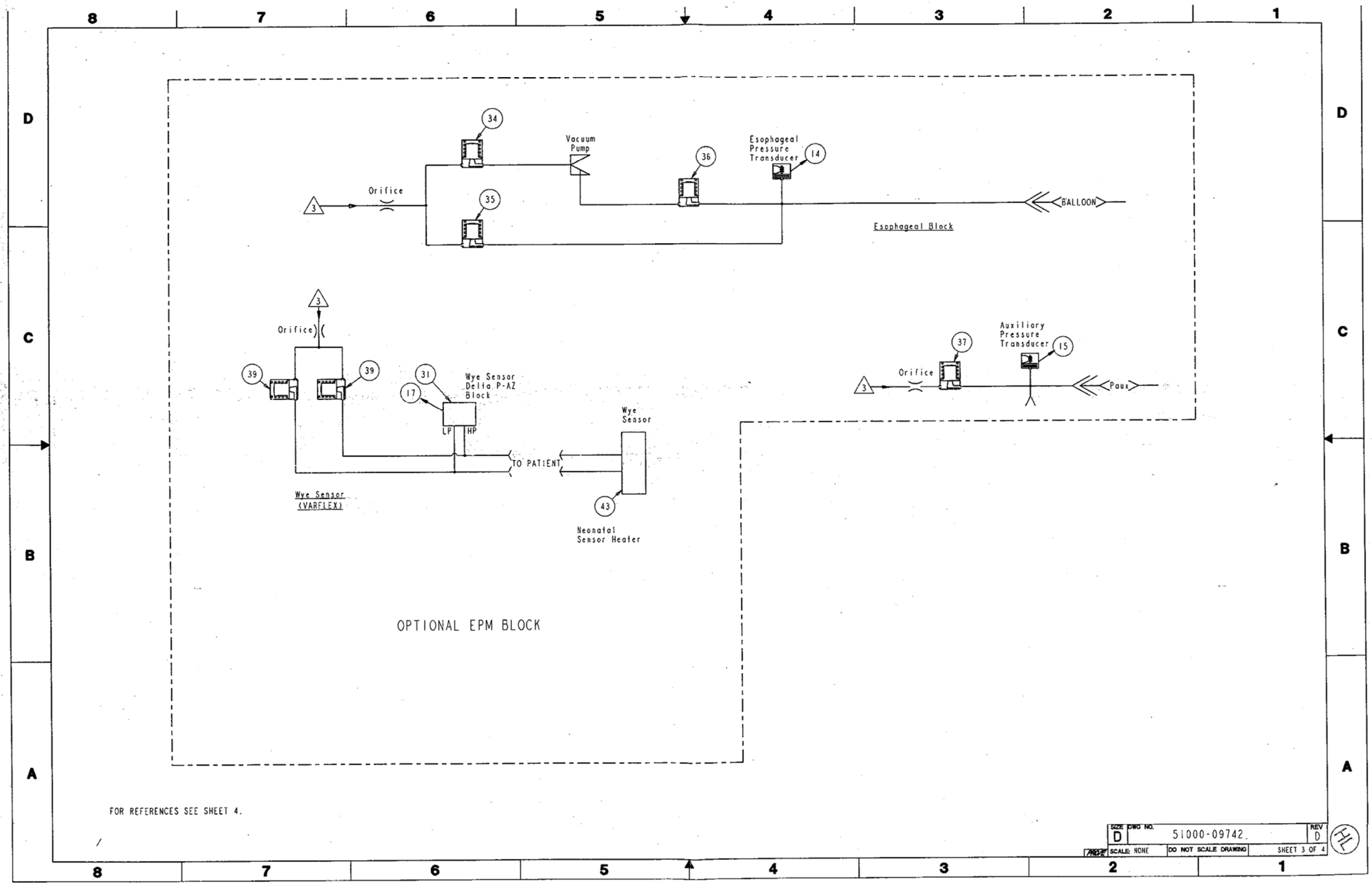
TITLE SCHEMATIC DIAGRAM, PNEUMATIC, AVEA

SIZE D
DWG NO. 51000-09742
REV D
SCALE: NONE
DO NOT SCALE DRAWING
SHEET 1 OF 4

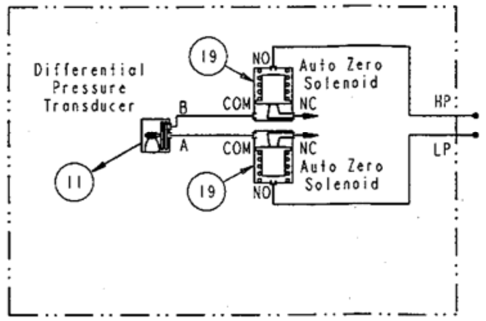

To GDE
30
Motor
Filter
Compressor
Filter
Optional Compressor

FOR REFERENCES SEE SHEET 4.

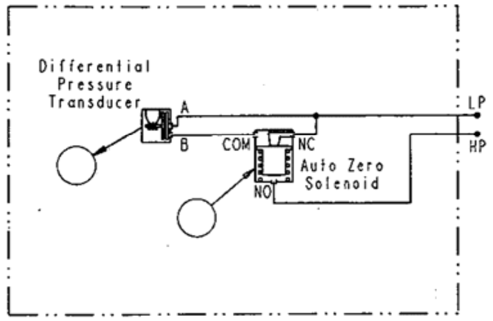
SIZE D
DWG NO. 51000-09742
REV D
SCALE: NONE
DO NOT SCALE DRAWING
SHEET 2 OF 4


8
7
6
5
4
3
2
1
D
C
B
A
34
Vacuum Pump
36
Esophageal Pressure Transducer
14
Orifice
3
35
BALLOON
Esophageal Block
3
Orifice
39
39
31
17
Wye Sensor Delta P-AZ Block
LP
HP
TO PATIENT
Wye Sensor
43
Neonatal Sensor Heater
Wye Sensor (VARFLEX)
Auxiliary Pressure Transducer
37
15
Orifice
3
Paux
OPTIONAL EPM BLOCK
FOR REFERENCES SEE SHEET 4.
SIZE
D
DWG NO.
51000-09742
REV
D
SCALE: NONE
DO NOT SCALE DRAWING
SHEET 3 OF 4
HL

INSPIRATORY FLOW DELTA P - AZ BLOCK



TYPICAL DELTA P-AZ BLOCK



COMMUNICATION BETWEEN BLOCKS

- △1 OVERBOARD EXHAUST.
- △2 ACCUMULATOR FLUSH/WATER DUMP EXHAUST.
- △3 BLENDED GAS FROM LOW PRESSURE REGULATOR
- △4 BLENDED GAS FROM SAFETY SV
- △5 AIR FROM WALL SOURCE

TRANSDUCER SIGNALS

1. AIR XDUCER
2. OXYGEN XDUCER
3. EXP FLOW DIF. XDUCER
4. EXP. XDUCER
5. INSP. TEMP. SENSOR
6. EXH SYSTEM TEMP. SENSOR
7. OXYGEN SENSOR
8. INSP XDUCER
9. NOT USED
10. GAS TYPE ID
11. INSP FLOW DIF. XDUCER
12. HOT WIRE SENSOR
13. BLENDED GAS XDUCER
14. PES XDUCER
15. AUXILIARY XDUCER
16. NOT USED
17. FAW DIF. XDUCER
18. NOT USED

CONTROL SIGNALS

19. INSP AZ SV
20. ACTIVE EXHALATION VALVE
21. EFS AZ SV
22. SAFETY SV
23. WATER DUMP SV
24. BLENDER STEPPER MOTOR
25. CROSSOVER SV
26. OXYGEN SWITCH SV
27. GAS CV
28. HEATER
29. FAN MOTOR
30. COMPRESSOR MOTOR
31. FAW AZ SV
32. NEBULIZER SV
33. BOOSTER DRIVE SV
34. VACUUM PUMP SV
35. ESOP FILL SV
36. ESOP EVACUATION SV
37. PROX PURGE SV
38. EFS PURGE SV
39. WFS PURGE SV
40. DELETED
41. DELETED
42. DELETED
43. NEONATOL SENSOR HEATER

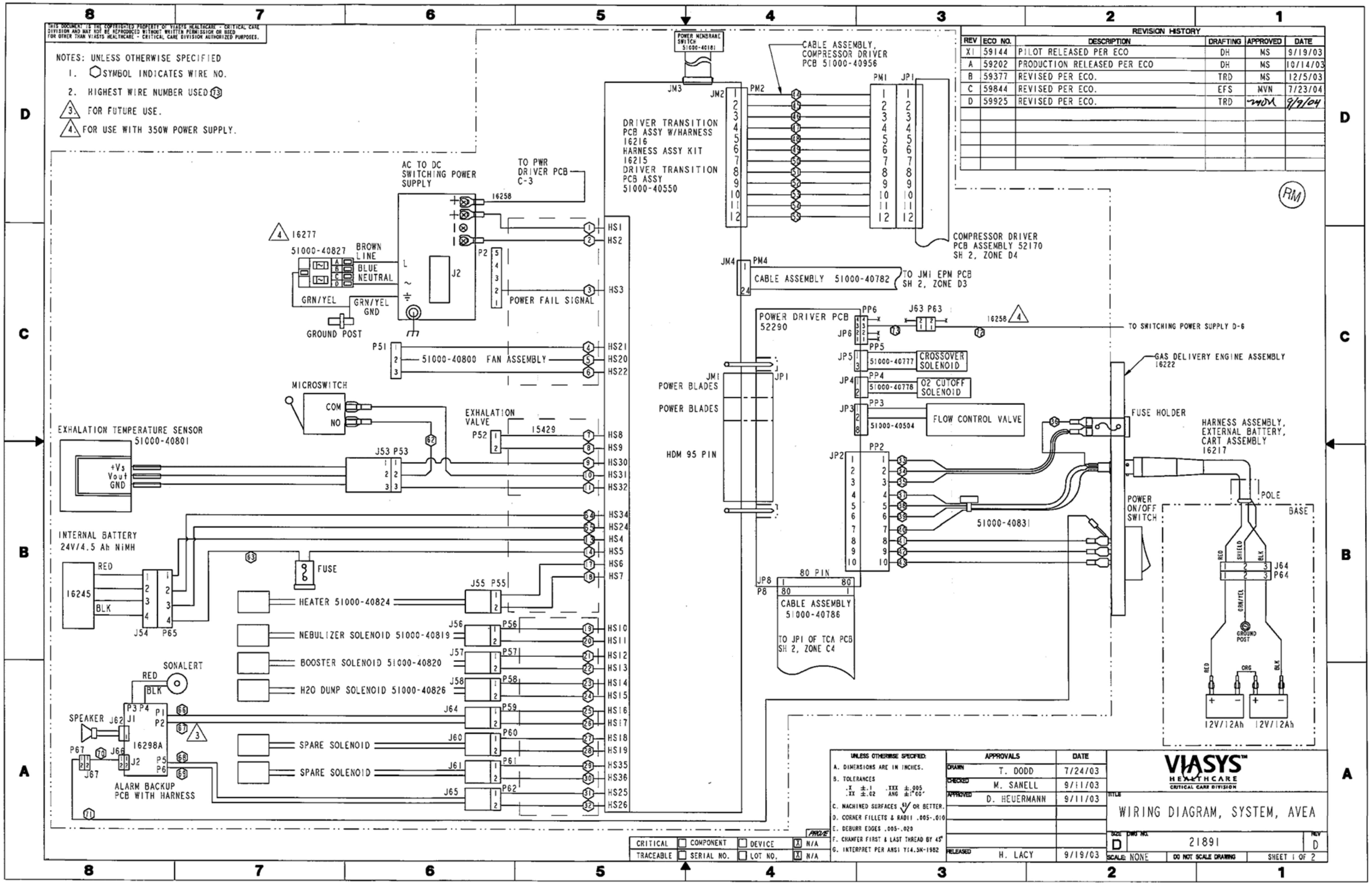
ABBREVIATIONS

AZ - AUTO ZERO.
CV - CONTROL VALVE.
DIF XDUCER - DIFFERENTIAL PRESSURE TRANSDUCER.
EFS - EXHALED FLOW SENSOR
EPM - ENHANCED PATIENT MONITORS
ESOP - ESOPHAGEAL.
EXH - EXHALATION
EXP - EXPIRATORY.
FAW - AIRWAY FLOW
GDE - GAS DELIVERY ENGINE.
HP - HIGH PRESSURE.
ID - IDENTIFIER.
INSP - INSPIRATORY.
LP - LOW PRESSURE.
PAUX - AUXILIARY PRESSURE
PAW - PROXIMAL (AIRWAY) PRESSURE.
PES - ESOPHAGEAL PRESSURE.
PR - PRESSURE RELIEF
PROX - PROXIMAL
SR - SAFETY / RELIEF VALVE.
SV - SOLENOID VALVE.
TEMP - TEMPERATURE.
WFS - WYE FLOW SENSOR
XDUCER - TRANSDUCER.

NOTE: SYSTEM IS SHOWN IN DE-ENERGIZED STATE.

SIZE	DWG NO.	REV
D	51000-09742	D
SCALE: NONE	DO NOT SCALE DRAWING	SHEET 4 OF 4

Wiring Diagram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8
7
6
5
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2
1
D
C
B
A
POWER MEMBRANE SWITCH 51000-40181
JM3
JM2
PM2
CABLE ASSEMBLY, COMPRESSOR DRIVER PCB 51000-40956
PM1
JP1
DRIVER TRANSITION PCB ASSY W/HARNESS 16216
HARNESS ASSY KIT 16215
DRIVER TRANSITION PCB ASSY 51000-40550
COMPRESSOR DRIVER PCB ASSEMBLY 52170 SH 2, ZONE D4
AC TO DC SWITCHING POWER SUPPLY
TO PWR DRIVER PCB C-3
16258
HS1
HS2
HS3
16277
51000-40827
BROWN LINE
BLUE NEUTRAL
L
J2
P2
POWER FAIL SIGNAL
GRN/YEL
GRN/YEL GND
GROUND POST
JM4
PM4
CABLE ASSEMBLY 51000-40782
TO JM1 EPM PCB SH 2, ZONE D3
POWER DRIVER PCB 52290
PP6
JP6
J63 P63
16258
TO SWITCHING POWER SUPPLY D-6
P51
51000-40800 FAN ASSEMBLY
HS21
HS20
HS22
PP5
JP5
51000-40777
CROSSOVER SOLENOID
GAS DELIVERY ENGINE ASSEMBLY 16222
MICROSWITCH
COM
NO
JM1 POWER BLADES
JP1
POWER BLADES
PP4
JP4
51000-40778
O2 CUTOFF SOLENOID
PP3
JP3
51000-40504
FLOW CONTROL VALVE
FUSE HOLDER
HARNESS ASSEMBLY, EXTERNAL BATTERY, CART ASSEMBLY 16217
EXHALATION VALVE
P52
15429
HS8
HS9
EXHALATION TEMPERATURE SENSOR 51000-40801
+Vs
Vout
GND
J53 P53
HS30
HS31
HS32
HDM 95 PIN
JP2
PP2
51000-40831
POLE
BASE
POWER ON/OFF SWITCH
HS34
HS24
HS4
HS5
HS6
HS7
INTERNAL BATTERY 24V/4.5 Ah NiMH
RED
16245
BLK
J54
P65
FUSE
J55 P55
HEATER 51000-40824
JP8
P8
80 PIN
CABLE ASSEMBLY 51000-40786
TO JP1 OF TCA PCB SH 2, ZONE C4
RED
SHIELD
BLK
J64
P64
GRN/YEL
GROUND POST
RED
ORG
BLK
J56
P56
NEBULIZER SOLENOID 51000-40819
HS10
HS11
J57
P57
BOOSTER SOLENOID 51000-40820
HS12
HS13
SONALERT
RED
BLK
J58
P58
H2O DUMP SOLENOID 51000-40826
HS14
HS15
P3 P4
P1
P2
SPEAKER
J62
J1
J64
P59
HS16
HS17
16298A
J60
P60
SPARE SOLENOID
HS18
HS19
P67
J66
J2
P5
P6
J67
J61
P61
SPARE SOLENOID
HS35
HS36
ALARM BACKUP PCB WITH HARNESS
J65
P62
HS25
HS26
12V/12Ah
12V/12Ah
RM

NOTES: UNLESS OTHERWISE SPECIFIED

1. ⬡ SYMBOL INDICATES WIRE NO.
2. HIGHEST WIRE NUMBER USED ⬡73
3. FOR FUTURE USE.
4. FOR USE WITH 350W POWER SUPPLY.

REVISION HISTORY

REV	ECO NO.	DESCRIPTION	DRAFTING	APPROVED	DATE
X1	59144	PILOT RELEASED PER ECO	DH	MS	9/19/03
A	59202	PRODUCTION RELEASED PER ECO	DH	MS	10/14/03
B	59377	REVISED PER ECO.	TRD	MS	12/5/03
C	59844	REVISED PER ECO.	EFS	MVN	7/23/04
D	59925	REVISED PER ECO.	TRD	MVN	9/9/04

CRITICAL	☐ COMPONENT	☐ DEVICE	☒ N/A
TRACEABLE	☐ SERIAL NO.	☐ LOT NO.	☒ N/A

UNLESS OTHERWISE SPECIFIED:
A. DIMENSIONS ARE IN INCHES.
B. TOLERANCES
.X ±.1 .XXX ±.005
.XX ±.02 ANG ±1°00'
C. MACHINED SURFACES 63/ OR BETTER.
D. CORNER FILLETS & RADII .005-.010
E. DEBURR EDGES .005-.020
F. CHAMFER FIRST & LAST THREAD BY 45°
G. INTERPRET PER ANSI Y14.5M-1982

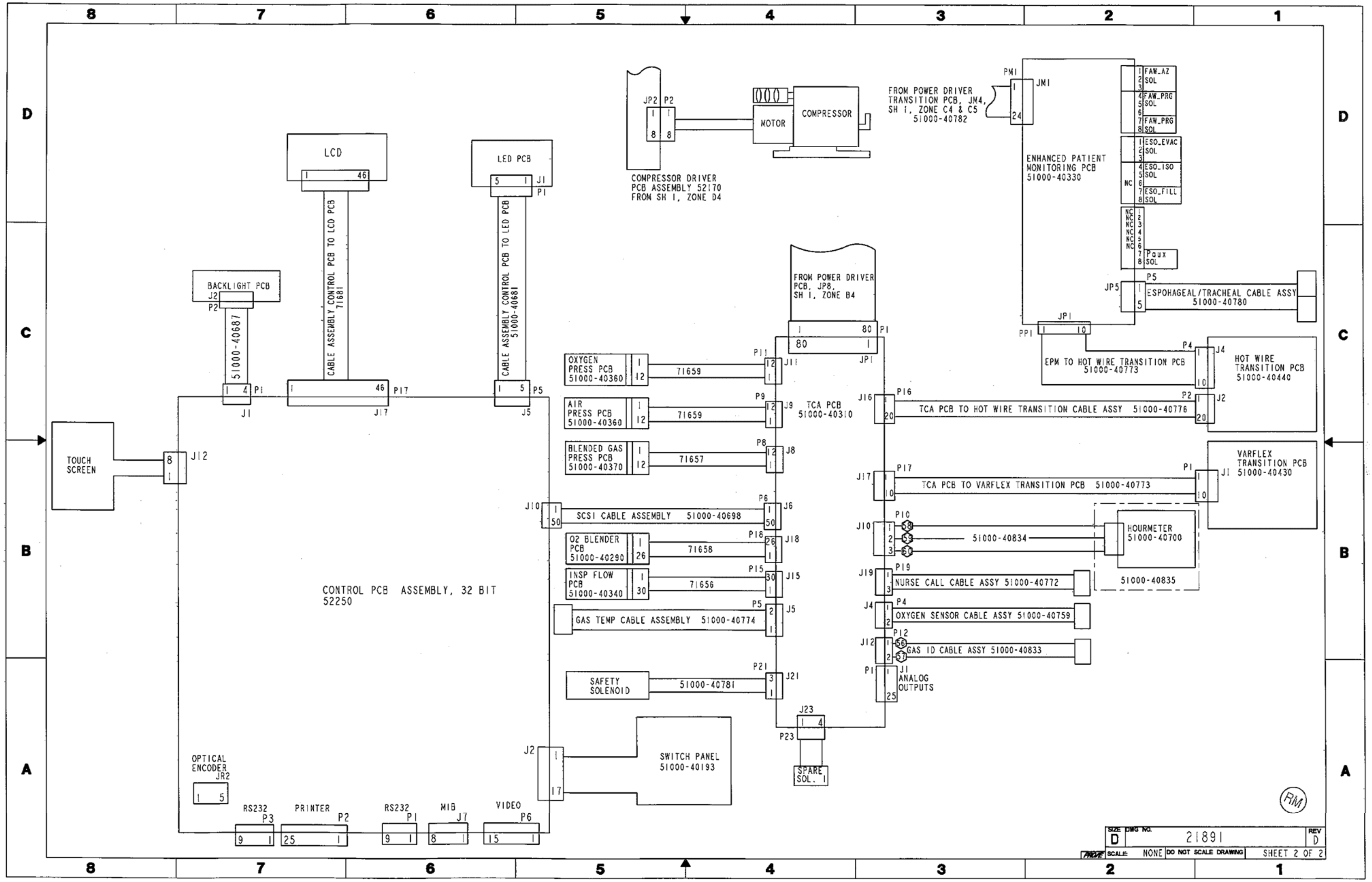
APPROVALS		DATE
DRAWN	T. DODD	7/24/03
CHECKED	M. SANELL	9/11/03
APPROVED	D. HEUERMANN	9/11/03
RELEASED	H. LACY	9/19/03

VIASYS™ HEALTHCARE CRITICAL CARE DIVISION

TITLE WIRING DIAGRAM, SYSTEM, AVEA

SIZE D DWG NO. 21891 REV D

SCALE: NONE DO NOT SCALE DRAWING SHEET 1 OF 2


8
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D
C
B
A
LCD
1 46
CABLE ASSEMBLY CONTROL PCB TO LCD PCB
71681
LED PCB
5 1 J1
P1
CABLE ASSEMBLY CONTROL PCB TO LED PCB
51000-40681
BACKLIGHT PCB
J2
P2
51000-40687
JP2 P2
MOTOR
COMPRESSOR
COMPRESSOR DRIVER
PCB ASSEMBLY 52170
FROM SH 1, ZONE D4
FROM POWER DRIVER
TRANSITION PCB, JM4,
SH 1, ZONE C4 & C5
51000-40782
PM1
JM1
ENHANCED PATIENT
MONITORING PCB
51000-40330
FAW_AZ SOL
FAW_PRG SOL
FAW_PRG SOL
ESO_EVAC SOL
ESO_ISO SOL
ESO_FILL SOL
NC
Paux SOL
JP5
P5
ESPOHAGEAL/TRACHEAL CABLE ASSY
51000-40780
JP1
PP1
FROM POWER DRIVER
PCB, JP8,
SH 1, ZONE B4
P1
JP1
EPM TO HOT WIRE TRANSITION PCB
51000-40773
P4
J4
HOT WIRE
TRANSITION PCB
51000-40440
TOUCH
SCREEN
J12
J1
P1
J17
P17
J5
P5
OXYGEN
PRESS PCB
51000-40360
71659
P11
J11
AIR
PRESS PCB
51000-40360
71659
P9
J9
TCA PCB
51000-40310
BLENDED GAS
PRESS PCB
51000-40370
71657
P8
J8
J10
SCSI CABLE ASSEMBLY 51000-40698
P6
J6
O2 BLENDER
PCB
51000-40290
71658
P18
J18
INSP FLOW
PCB
51000-40340
71656
P15
J15
GAS TEMP CABLE ASSEMBLY 51000-40774
P5
J5
SAFETY
SOLENOID
51000-40781
P21
J21
CONTROL PCB ASSEMBLY, 32 BIT
52250
J2
SWITCH PANEL
51000-40193
J23
P23
SPARE
SOL. 1
OPTICAL
ENCODER
JR2
RS232
P3
PRINTER
P2
RS232
P1
MIB
J7
VIDEO
P6
J16
P16
TCA PCB TO HOT WIRE TRANSITION CABLE ASSY 51000-40776
P2
J2
VARFLEX
TRANSITION PCB
51000-40430
J17
P17
TCA PCB TO VARFLEX TRANSITION PCB 51000-40773
P1
J1
J10
P10
51000-40834
HOURMETER
51000-40700
51000-40835
J19
P19
NURSE CALL CABLE ASSY 51000-40772
J4
P4
OXYGEN SENSOR CABLE ASSY 51000-40759
J12
P12
GAS ID CABLE ASSY 51000-40833
P1
J1
ANALOG
OUTPUTS
RM
SIZE
D
DWG NO.
21891
REV
D
SCALE
NONE
DO NOT SCALE DRAWING
SHEET 2 OF 2

Specifications

Pneumatic Supply

Air or Heliox Supply

Pressure Range: 20 to 80 psig (Supply Air)
20 to 80 psig (Supply Heliox)
3 to 10 psig (Compressor Air)

Temperature: 10 to 62 °C (50 to 143.6 °F)

Humidity: Dew Point of gas should be 1.7 °C (3 °F) below the ambient temperature (minimum)

Minimum Flow: 80 L/MIN at 20 psig

Inlet Fitting: CGA DISS-type body, No. 1160 (Air)
CGA DISS-type body, No. 1180 (Heliox)

The 1180 fitting is available from most Medical Specialty Gas suppliers. One such company is Superior Products in Cleveland, Ohio (216) 651-9400 P/N MA692

Oxygen Supply

Pressure Range: 20 to 80 psig (Supply Oxygen)

Temperature: 10 to 40 °C (50 to 104 °F)

Humidity: Dew Point of gas should be 1.7 °C (3 °F) below the ambient temperature (minimum)

Minimum Flow: 80 L/MIN at 20 psig

Inlet Fitting: CGA DISS-type body, No. 1240

Electrical Supply

AC Power Supply

The ventilator operates within specification when connected to the following AC power supplies:

Nominal	Voltage Range	Frequency Range
100 VAC	(85 to 110 VAC)	47 to 65 Hz
120 VAC	(102 to 132 VAC)	55 to 65 Hz
230 VAC	(196 TO 253 VAC)	47 to 65 Hz
240 VAC	(204 TO 264 VAC)	47 to 65 Hz

DC Power Supply

The ventilator can also operate from a 24 VDC power source (internal or external battery).

Internal Battery:

The ventilator operates within specification for a minimum duration of 30 minutes when operated on the internal battery. With the compressor active; one hour on a 50 PSI air.source Maximum charge time to achieve a full charge is 8 to 12 hours.

External Battery:

22.0 to 26.4 VDC With use of the external batteries, the ventilator will operate for 2 hours with compressor active and 6 hours on a 50 PSI air source.

Data Input / Output

Analog Inputs

The ventilator provides up to 8 programmable channels for analog signal inputs. Each channel shall be scalable for the input ranges specified.

Ranges:	0 to 1 VDC
	0 to 5 VDC
	0 to 10 VDC
Resolution:	0.25 mV (for 0 to 1 VDC)
	1.37 mV (for 0 to 5 VDC)
	2.5 mV (for 0 to 10 VDC)

Analog Outputs

The ventilator provides 4 signals to the analog output connector:

1. Airway Pressure, PAW:

Connection	DB25 connector, pin 22. Ground pins 9-13
Range:	-60 to 140 cmH_2O
Scale:	1 cmH_2O/25 mV
Accuracy:	± 50 mV or ± 5% of reading, whichever is greater
Zero Offset:	1.5 VDC at 0 cmH_2O

2. Flow

Connection	DB25 connector, pin 23. Ground pins 9-13

Inspiratory/Expiratory flow:

When selected, the ventilator provides a continuous analog voltage representative of inspiratory flow minus expiratory flow.

Range:	-300 to 200 L/MIN	(Adult)
	-120 to 80 L/MIN	(Pediatric)
	-60 to 40 L/MIN	(Neonate)
Scale Factor:	1 L/MIN / 10 mV	(Adult)

1 L/MIN / 25 mV (Pediatric)
1 L/MIN / 50 mV (Neonate)

Accuracy: ± 10% of reading or ± 30 mV, whichever is greater

Zero Offset: 3.0 VDC at 0 L/MIN

Machine:

When selected the ventilator provides a continuous analog voltage representative of machine delivered flow.

Range: 0 to 200 L/MIN (Adult)
0 to 100 L/MIN (Pediatric)
0 to 50 L/MIN (Neonate)

Scale Factor: 1 L/MIN / 25 mV (Adult)
1 L/MIN / 50 mV (Pediatric)
1 L/MIN / 100 mV (Neonate)

Accuracy: ± 10% of reading or ± 30 mV, whichever is greater

Zero Offset: None

3. Volume:

Connection DB25 connector, pin 24. Ground pins 9-13

Range: -1.00 to 4.00 L (Adult)
-200 to 800 mL (Pediatric)
-100 to 400 mL (Neonate)

Scale Factor: 1 L / V (Adult)
1 mL / 5 mV (Pediatric)
1 mL / 10 mV (Neonate)

Accuracy: ± 10% of reading or ± 30 mV, whichever is greater

Zero Offset: 1.000 VDC

4. Breath Phase

Connection DB25 connector, pin 25. Ground pins 9-13.

The ventilator provides a continuous analog voltage representative of breath phase (Inspiration = 5 VDC, Expiration = 0 VDC).

Digital Communication

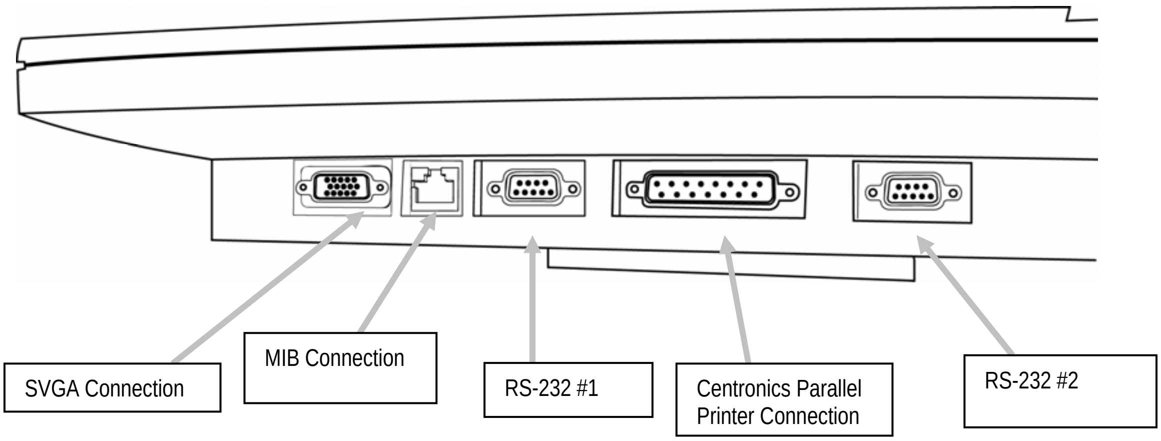


Figure A-1 Connections beneath the UIM screen

The ventilator has two RS-232 ports on the UIM for bi-directional communication of data: RS-232 Ch1 and RS-232 Ch2. RS232-1 DB9-F connector is active for software upgrades and the Avea communication protocol, recommended to connect only to Viasys applications.

RS-232-Channel 2 DB9-F is reserved for future applications.

Printer

The ventilator UIM has a standard 25-pin female Centronics parallel printer port, DB25-F, active on all models for use with HP color deskjet printers with parallel interface.

Printing from the Avea

1. The print screen is compatible with Hewlett Packard 300 and 900 series printers.
2. The port is on the underside of the UIM fairly in the middle. A “printer” symbol has been placed on the UIM directly above the port itself.
3. It is a parallel printer port.
4. After connecting the appropriate printer you may print a screen at any time.
5. Press “FREEZE” to capture the screen data.
6. Press “PRINT” and the screen will be printed.

Video Output (SVGA Connection)

The ventilator UIM provides a video output connector which allows for interfacing to an externally located 256-color, 800 x 600, SVGA monitor.

MIB Connection

Configuration of the AVEA to communicate with interfaces always requires setting the baud rate and communication parameter to match the host device. From the Main Screen, press:

SCREENS → UTILITIES → INPUT/OUTPUT →RS 232 Output:

Rotate the DATA DIAL until the applicable selection appears.

Press the “ACCEPT” button.

In the same manner, set the baud rate and communication parameter to match the host device.

The AVEA will then be configured to communicate with the interface selected.

When properly connected, the communication ICON in the AVEA INPUT/OUTPUT screen will be present.

GSP (Generic Serial Protocol)

This interface is available in AVEA software versions 3.3 and greater. The AVEA GSP Interface Kit is P/N 16375 and includes a CAT-5 Cable and a 9 pin adapter.

Phillips Vue Link

AVEA software versions 3.1 and greater may be interfaced with the Phillips Vue Link system. The P/N for the Vue-Link CAT 5 serial cable and adapter is 16337.

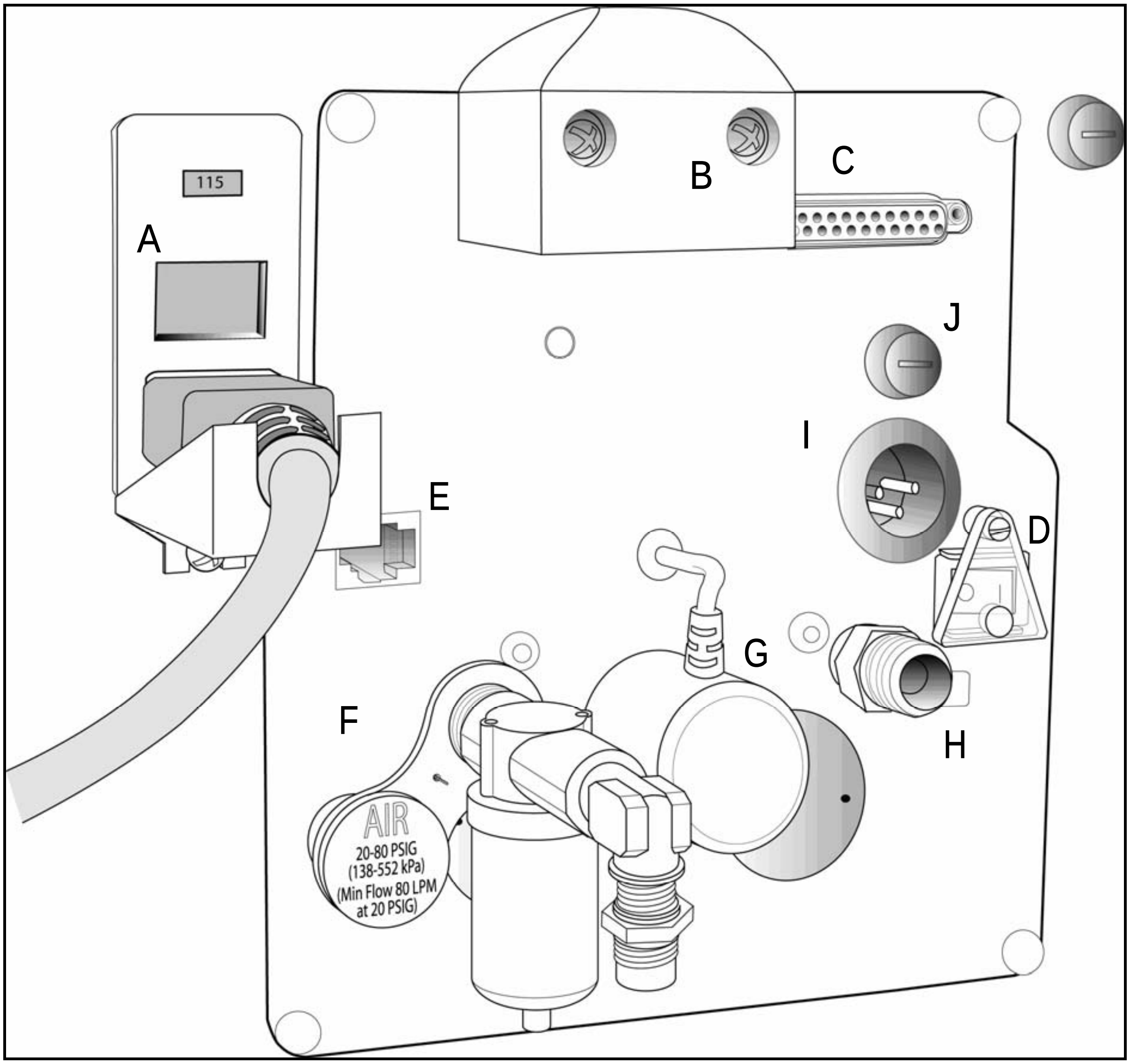

115
A
B
C
J
I
E
D
G
F
H
AIR
20-80 PSIG
(138-552 kPa)
(Min Flow 80 LPM
at 20 PSIG)

Figure A-2 Figure 2.19 Rear Panel

A – AC power module
B – UIM connection
C – Analog input/output/ILV
D - Power ON/OFF Switch
E – Nurse call system connection
F – Air smart connector
G – Oxygen sensor
H – Oxygen hose connection
I – External battery connector
J – External battery fuse

Remote Nurse Call

The ventilator has a modular jack configured to interface with external systems that are either wired for normally open (N.O., close on alarm) or normally closed (N.C., open on alarm) signals.

In the active state, the remote alarm can sink 1.0 A.

The Remote Nurse Call cable may be permanently affixed to the AVEA ventilator.

1. Remove paper backing from the cable bridge P/N 08231 and attach the bridge sticky side to the location as show in the photo provided.
2. Insert the Remote Nurse Call cable into the receptacle until it clicks and locks into the position.
3. Insert the cable tie P/N 07803 provided through the cable bridge, bend the Remote Nurse Call cable as show in the photo against the top of the cable bridge.
4. Insert the pointed end of the cable tie through the opposite locking end of the cable tie and pull it finger tight only against the Remote Nurse Call cable.
5. Ensure that the Remote Nurse Call Cable has a slight looping bend to it and not a sharp 90-degree bend. This will ensure there is not undo stress applied to the Remote Nurse Call cable.

   Cut off the excess cable tie flush with the locking portion of the cable tie.

Independent Lung Ventilation (ILV)

The ventilator provides an output (master) and an input (slave) for synchronization of ventilators. The output supplies a 5 VDC logic signal synchronized to the breath phase of the master. ILV CABLE P/N 16124 ILV CABLE KIT P/N 16246

Atmospheric & Environmental Specifications

Temperature and Humidity

Storage

Temperature:	–20 to 60 °C (–4 to 140 °F)
Humidity:	0 to 95% RH non-condensing

Operating

Temperature:	5 to 40 °C (41 to 104 °F)
Humidity:	0 to 95% RH non-condensing

Barometric Pressure

760 to 545 mmHg

Blender Bleed

The bleed rate from the relay is 2.3 SLPM (O2).

The bleed to the O2 sensor is approximately 0.1 SLPM (blended gas).

The bleed specification is 7.5 +/- 0.5 LPM at 9 +/- 0.5 PSI at the accumulator. When there is sufficient minute ventilation to keep the pressure below that value, the bleed is shut off.

Sound Levels

Measured at three meters in front of the AVEA ventilator:

Lowest Alarm Level – 55dBA.

Highest Alarm Level – 75 dBA.

Physical Dimensions

Overall Size

Ventilator	17" W x 16" D x 10.5" H
UIM	16.25" W x 2.5" D x 13.75" H

Weight

Ventilator w/ UIM	$\leq$ 73 lbs.
Compressor	$\leq$ 7 lbs.

Accessories

Pall Microbial Filter

Resistance:

The exhalation filter supplied with your AVEA ventilator is manufactured by Pall Medical of Ann Arbor, MI, USA. The published maximum resistance of this filter is 4 cmH2O at 20 L/min for the Intervene 255 Filter (small) and 4cm H2O at 100 L/min for the 725 (large) filter.

Compliance:

The compliance for the small filter is < 0.5 ml/cmH2O and for the large filter is < 0.4 ml/cmH2O

Materials:

Materials used in the construction of both filters have passed USP Class VI 121° C Plastic and Cytoxicity test.

For further information please contact Pall Medical.

Water Trap

Resistance:

The resistance of the small water trap assembly including the collection bottle is < than 0.25 cmH2O at 20 L/min.

Compliance:

The compliance of both water trap assemblies including the collection bottle is < 0.2 ml/cmH2O.

Wave	Sigh	Ptrig	Vsync	Trise Vsync	Tsync high	Tsync low	PSVhigh

Definition:	Fbias	L/min x10	Bias Flow (Bias Flow)
	Vmach	mL x10	Machine Volume (Mach Vol)
	Vlimit	mL x10	Volume Limit (Vol Limit)
	Trise	1..9	Pressure Control Rise Time (Rise Time)
	Fcycle	% ?5	Flow Cycle % of PIFR (Flow Cycle)
	Trise-psv	1..9	PSV Rise Time (PSV Rise)
	Fcycle-psv	%	PSV Flow Cycle % of PIFR (PSV Cycle)
	Tmax-psv	sec x100	PSV Maximum Inspiratory Time (PSV Tmax)
	Wave	0/1	Decelerating Flow Volume Waveform OFF/ON (Waveform)
	Sigh	0/1	Sigh Volume Breath OFF/ON (Sigh)
	Ptrig	cmH2O x10	Pressure Trigger Sensitivity (Pres Trig)
	Vsync	0/1	Vsync mode OFF/ON (Vsync)
	Trise-Vsync	1..9	Vsync Rise Time (Vsync Rise)
	Tsync-high	%	Sync Window % of APRV/BiPhasic Time High (T High Sync)
	Tsync-low	%	Sync Window % of APRV/BiPhasic Time Low (T Low Sync)
	PSVhigh	0/1	PSV OFF/ON with APRV/BiPhasic Pres High(T High PSV)

Body Size: 8 words (32 bytes). Each field, signed 16-bit integer; little endian.

Value: Per definition.

RUSSIAN

TURKISH

JAPANESE

Alm FiO2 (O2 Alarm)

Definition: Enable/Disable setting of FiO2 Alarm.

Size: Two (2) bytes; unsigned 16-bit integer; little endian.

Value:	ENABLED	0
	DISABLED	1

Aout (Analog Output Type)

Definition:	Selection of Flow Waveform for Analog Output.	
Size:	Two (2) bytes; unsigned 16-bit integer; little endian.	
Value:	Wye Flow	0
	Machine Flow	1

ILV Mode (ILV Mode)

Definition:	Independent Lung Ventilation configuration of ventilator.	
Size:	Four (4) bytes; unsigned 32-bit integer; little endian.	
Value:	ILV OFF	0
	ILV MASTER	1
	ILV SLAVE	2

Ain Gain(Analog Input Gain)

Definition:	Selection of Amplifier Gain applied to Analog Inputs.	
Size:	Two (2) bytes; unsigned 16-bit integer; little endian.	
Value:	High Gain; 0-1V	0xFFFF
	Med. Gain; 0-5V	0xAAAA
	Low Gain; 0-10V	0x0000

Pbaro (Baro Pres)

Definition:	Barometric pressure setting of ventilator environment.
Size:	Two (2) bytes; signed 16-bit integer; little endian.
Value:	Per definition; mmHg.

Operational Settings Data

1st						7th
Mode	AAC	ETT Len	ETT Dia	Leak Comp	CCC k	Humid

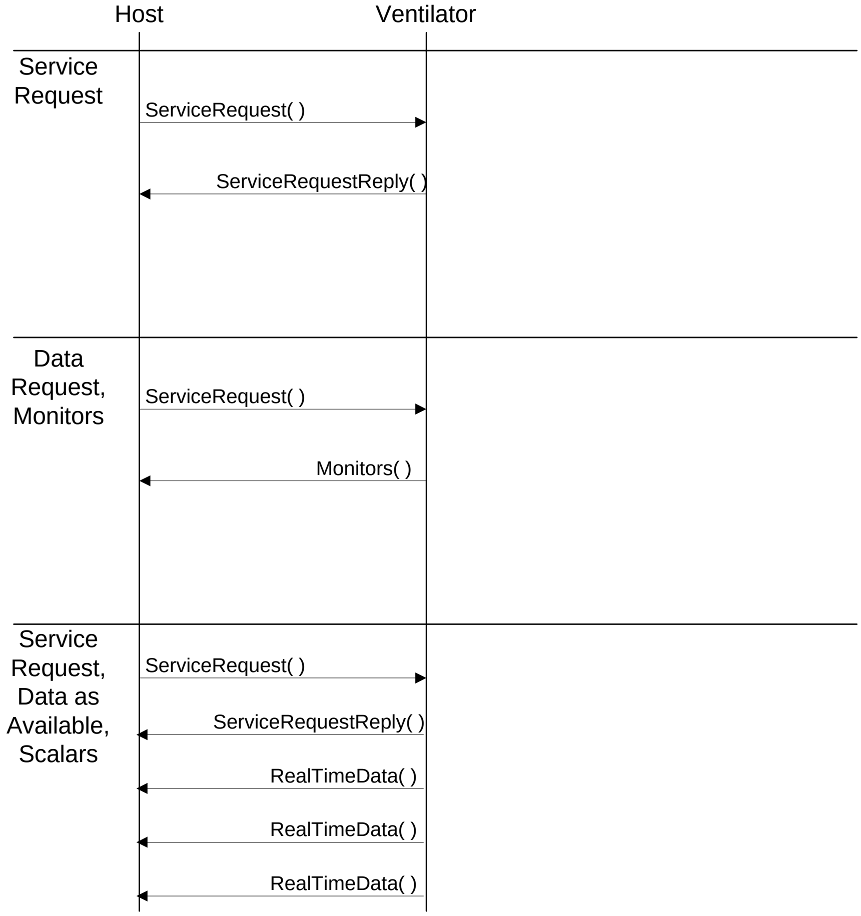
Body Size:	4 words (16 bytes); each field see below.
Value:	N/A.

Mode (Mode)

Definition:	Breath delivery Mode setting.

Exchange Protocol

The following describes several typical transaction sequences for this protocol. Others are possible, but are analogous to or extensions of those presented.


Host
Ventilator
Service Request
ServiceRequest( )
ServiceRequestReply( )
Data Request, Monitors
ServiceRequest( )
Monitors( )
Service Request, Data as Available, Scalars
ServiceRequest( )
ServiceRequestReply( )
RealTimeData( )
RealTimeData( )
RealTimeData( )

Default

The default transmission mode for all data types is "By Request".

Disabled State

All data transmission may be disabled under certain circumstances, for example, if an alternate data channel (MIB) is selected for communication. In this case, all Service

Requests will be replied with a failure message.

AVEA Message Bar Text

AVEA MESSAGE BAR TEXT	CAUSE
"Confirm Apnea Settings."	Selection of CPAP/PSV or APRV on Mode Select popup when active.
"Proximal Flow Sensor required."	Acceptance of Volume Limit setting when Size is NEO, Volume Limit is active, and no Wye Flow Sensor connected (Varflex or Hotwire).
"Bias Flow insufficient to allow Flow Trigger."	Acceptance of Bias Flow setting or Flow Trigger setting when Flow Trigger < (Bias Flow + 0.5 lpm).
"Heliox concentration will change."	Acceptance of %O2 setting when Heliox is being used.

AVEA MESSAGE BAR TEXT	CAUSE
"Nebulizer not available."	Acceptance of Peak Flow setting < 15 lpm when Nebulizer is active or on pressing of Nebulizer membrane key when Peak Flow setting < 15 lpm
"Confirm inspiratory pressure settings."	Selection of Volume Limit control when Volume Limit active (i. e., not at default / highest value for patient size).
"Settings restored to defaults."	Patient Accept when New Patient selected.
"Compliance Compensation not active for NEO."	Size Accept when Size is NEO, and Circ Comp setting is non-zero.
"Minimum 0.2 sec Inspiratory Time."	Acceptance of any combination of settings that will produce an I-Time of less than 0.2 seconds.
"Maximum 4:1 I:E Ratio."	Acceptance of any combination of settings that will produce an I:E Ratio of 4:1 or greater.
"Maximum 3 sec Inspiratory Time."	Acceptance of any combination of settings when size is NEO that will produce an I-Time of greater than 3 seconds.
"Maximum 5 sec Inspiratory Time."	Acceptance of any combination of settings when size is PED or ADULT that will produce an I-Time of greater than 5 seconds.
"Invalid Calibration"	**Service State Only:** Validation failure, while calibration dialog box is active for selected device.
"Error saving Serial/Model Number"	**Service State Only:** On accept of Serial Number or Model Number Change.
Clear Messages	**Service State Only:** Validation success, while calibration dialog box is active for selected device.
"FCV Characterization in progress."	**Service State Only:** On start of Flow Control Valve characterization procedure.
"FCV Characterization complete."	**Service State Only:** On successful completion of Flow Control Valve characterization procedure.
"FCV Characterization failed."	**Service State Only:** Unsuccessful completion of Flow Control Valve characterization procedure. Validation failure characterization and tuning data.
Installed Software Version	Power Up
Current Time, Date, and Runtime Hours	Main key pressed.
“DPRAM Comm. Error, Ctrl"	Loss of Communication with Control microprocessor
"Printing."	Print Screen button was pressed; commenced sending screen data to printer.
"Printer Out of Paper."	Print Screen button was pressed, printer reported it is out of paper.
"Printer Offline."	Print Screen button was pressed; printer is not available.
"Printer Error."	Print Screen button was pressed; printer reported an error condition.
"Printer Ready."	Sending screen data to printer has completed.
"Printer Busy."	Print Screen button was pressed, device has not completed sending data from previous activation.

AVEA MESSAGE BAR TEXT	CAUSE
"Volume Limit disabled."	On disconnect of WFS (Neo or Hotwire) when Size is NEO and Volume Limit is active.
"Proximal Flow Sensor disconnected."	On disconnect of WFS, any type.
"Flow sensor is not Heliox-compatible."	On connect of Hotwire WFS when Heliox is active.
"Proximal Airway Line disconnected."	On disconnect of Proximal Pressure connection.
"Proximal Flow Sensor conflict.	On simultaneous connect of Hotwire and VarFlex WFS.
"Esophageal monitoring not available."	On connect of Esophageal Balloon when size is NEO.
"Tracheal monitoring not available."	On connect of Tracheal Catheter when size is NEO.
"Flow Sensor Error."	On power up, failure to validate any internal flow sensor.
"Wye Sensor Error."	On connect and failure to validate any proximal flow sensor.
"Device Error."	On detection of a fault classified as “Device Error” (see Fault Section)
"Esophageal Balloon Leak Test Failed."	On failure of Esophageal Balloon leak test.
“Stopped: Patient Effort Detected”	Upon detecting Patient effort in maneuvers which require a passive patient
“Proximal Flow Sensor Ready”	

Adjusting Barometric Pressure for Altitude

The default setting for barometric pressure on AVEA is 760 mm Hg. For institutions at altitudes of 1000 feet or greater, barometric pressure can be set by the operator.

Open the screens menu by pressing the screen indicator on the touch screen or the “SCREENS” membrane button located to the left of the touch screen.

Select utility from the screens menu. Press the touch screen button for barometric pressure and use the data dial to change the setting. Once you have reached the desired barometric pressure setting, press the “ACCEPT” membrane button adjacent to the data dial.

To close the utilities screen and return to the main screen, press the screen indicator again and select MAIN from the menu or press the membrane button to the left of the touch screen labeled “MAIN”.

Below is a chart of approximate Barometric Pressure at varying altitude:

Table G.1 Altitude to Barometric Pressure Conversion[1]

Altitude (ft)	Barometric Pressure (mm Hg)
0	760
1000	733
2000	707
3000	681
4000	656
5000	632
6000	609
7000	588
8000	567
9000	545

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[1] *CRC Handbook of Chemistry and Physics 61st Edition,1980-1981, CRC Press, Inc. Boca Raton, Florida*

Monitor Ranges and Accuracies

DISPLAY	DESCRIPTION	RANGE	ACCURACY
VOLUME MONITORS			
The volume measured during the inspiratory phase of the breath is accumulated as the inspired tidal volume, and the volume measured during the exhalation phase is accumulated as the exhaled tidal volume. This volume does not include the volume delivered by the Circuit Compliance Compensation function for volume breaths.			
Vte	Exhaled tidal volume.	0 to 4 L	(± 20ml + 10% of reading)- Adult machine sensor (± 1 ml + 10% of reading)- Neonate wye sensor
Vte/kg	Exhaled tidal volume adjusted for patient weight	0 to 4 ml/kg	
Vti	Inspired tidal volume.	0 to 4 L	(± 20ml + 10% of reading)- Adult machine sensor (± 1 ml + 10% of reading)- Neonate wye sensor
Vti/kg	Inspired tidal volume adjusted for patient weight	0 to 4 ml/kg	
Spon Vt	Spontaneous tidal volume.	0 to 4 L	(± 20ml + 10% of reading)- Adult machine sensor (± 1 ml + 10% of reading)- Neonate wye sensor
Spon Vt/kg	Spontaneous tidal volume adjusted for patient weight	0 to 4 ml/kg	
Mand Vt	Mandatory tidal volume. Displayed as a rolling average of either 8 breaths or one minute, whichever occurs first.	0 to 4 L	(± 20ml + 10% of reading)- Adult machine sensor (± 1 ml + 10% of reading)- Neonate wye sensor
Mand Vt/kg	Mandatory tidal volume adjusted for patient weight	0 to 4 ml/kg	Derived
Vdel	Delivered machine volume measured by the ventilator's inspiratory flow sensor.	0 to 4L	(± 20ml + 10% of reading)-
% Leak	Percent leakage. The difference between the inspired and exhaled tidal volumes in terms of % difference.	Derived	Derived

DISPLAY	DESCRIPTION	RANGE	ACCURACY
Ve	Minute Volume. Volume of gas exhaled by the patient during the last minute.	0 to 99.9 L	Derived
Ve/kg	Minute volume adjusted for patient weight	0 to 999 ml/kg	Derived
Spon Ve	Spontaneous minute volume.	0 to 99.9L	Derived
Spon Ve/kg	Spontaneous minute volume adjusted for patient weight	0 to 999ml/kg	Derived
RATE/TIME MONITORS			
Rate	Breath Rate.	0 to 200 bpm	± 3% or ± 2 bpm whichever is greater
Spon Rate	Spontaneous breath rate.	0 to 200 bpm	± 3% or ± 2 bpm whichever is greater
Ti	Inspiratory time.	0.00 to 99.99 sec	± 0.03 sec
Te	Exhalation Time.	0.00 to 99.99 sec	± 0.03 sec
I:E	Inspiratory/expiratory ratio *Note: Not active for demand breaths.*	1:99.9 to 99.9:1	Derived from accuracies for monitored Ti and Te
f/Vt	Rapid shallow breathing index.	0 to 500 b^2/min/L	Derived from accuracies for spontaneous breath rate and spontaneous minute volume
PRESSURE MONITORS			
Ppeak	Peak inspiratory pressure. Not active with spontaneous breaths	0 to 120 cmH_2O	± 3.5% of reading or ± 2 cmH_2O, whichever is greater
Pmean	Mean airway pressure.	0 to 120 cmH_2O	± 3.5% of reading or ± 2 cmH_2O, whichever is greater
Pplat	Plateau pressure. If no plateau occurs, then the monitor displays * * *	0 to 120 cmH_2O	± 3.5% of reading or ± 2 cmH_2O, whichever is greater
PEEP	Positive end expiratory pressure.	0 to 60 cmH_2O	± 3.5% of reading or ± 2 cmH_2O, whichever is greater
Air Inlet	Air inlet gas supply pressure.	0 to 80 psig	± 5 psig (1.4 – 5.5 bar)
O_2 Inlet	Oxygen inlet gas supply pressure.	0 to 80 psig	± 5 psig (1.4 - 5.5 bar)
GAS COMPOSITION MONITORS			

DISPLAY	DESCRIPTION	RANGE	ACCURACY
FiO_2	Delivered percent O_2.	0 to 100%	± 3%
MECHANICS			
Cdyn	Dynamic Compliance (C_{DYN} and C_{DYN} / Kg), absolute and normalized to patient weight.	0 to 300 ml/cmH_2O	Derived
Cdyn/Kg		0.00 to 5.00 ml/cmH_2O·kg	
Cstat	Respiratory System Compliance (C_{RS}), (a.k.a. Static Compliance C_{STAT}), absolute and normalized to patient weight. *Note: This requires an Inspiratory Hold maneuver.*	0 to 300 ml/cmH_2O	Derived
Cstat/Kg		0.00 to 5.00 ml/cmH_2O·kg	
Rrs	Respiratory system resistance. *Note: Calculation is performed during an Inspiratory Hold maneuver.*	0 to 100 cmH_2O/L/sec	Derived
PIFR	Peak Inspiratory flow rate.	0 to 300 L/min (All patients)	± 10% of setting or ± (0.2 L/min + 10% of setting), whichever is greater
PEFR	Peak Expiratory flow rate.	0 to 300 L/min (All patients)	± 10% of setting or ± (0.2 L/min + 10% of setting), whichever is greater
Ccw	The ratio of the tidal volume (exhaled) to the Delta Esophageal Pressure (dP_{ES}). Requires an esophageal balloon.	0 to 300 mL/cmH_2O	± 10%
C_{LUNG}	The ratio of the tidal volume (exhaled) to the delta transpulmonary pressure. The delta transpulmonary pressure is the difference between the airway plateau pressure (during an inspiratory pause) and esophageal pressure (at the time the airway plateau pressure is measured) minus the difference between the airway and esophageal baseline pressures. Requires an inspiratory hold and esophageal balloon.	0 to 300 mL/cmH_2O	± 10%

DISPLAY	DESCRIPTION	RANGE	ACCURACY
C_{20} / C	The ratio of the dynamic compliance during the last 20% of inspiration (C_{20}) to the total dynamic compliance (C).	0.00 to 5.00	± 10%
R_{RS}	The total resistance during the inspiratory phase of a breath. Respiratory System Resistance is the ratio of the airway pressure differential (peak – plateau) to the inspiratory flow 12 ms prior to the end of inspiration. Requires an inspiratory hold.	0 to 100 $cmH_2O/L/sec$	± 10%
R_{PEAK}	The Peak Expiratory Resistance (R_{PEAK}), is defined as the resistance at the time of the Peak Expiratory Flow (PEFR).	0.0 to 100.0 $cmH_2O/L/sec$	± 10%
R_{IMP}	The airway resistance between the wye of the patient circuit and the tracheal sensor. Requires an inspiratory hold and tracheal catheter.	0.0 to 100.0 $cmH_2O/L/sec$	± 10%
R_{LUNG}	The ratio of the tracheal pressure differential (peak – plateau) to the inspiratory flow 12 ms prior to the end of inspiration. Requires an inspiratory hold and tracheal catheter.	0.0 to 100.0 $cmH_2O/L/sec$	± 10%
dP_{AW}	The difference between peak airway pressure ($P_{PEAK\ AW}$) and baseline airway pressure ($PEEP_{AW}$).	–120 to 120 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater
dP_{ES}	The difference between peak esophageal pressure ($P_{PEAK\ ES}$) and baseline esophageal pressure ($PEEP_{ES}$).	–120 to 120 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater
AutoPEEP	The airway pressure at the end of an expiratory hold maneuver. Requires a passive patient.	0 to 50 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater

DISPLAY	DESCRIPTION	RANGE	ACCURACY
dAutoPEEP	The difference between airway pressure at the end of an expiratory hold maneuver and the airway pressure at the start of the next scheduled breath after the expiratory hold maneuver. Requires a passive patient.	0 to 50 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater
AutoPEEP_{ES}	The difference between esophageal pressure measured at the end of exhalation (PEEP_{ES}) minus the esophageal pressure measured at the start of a patient-initiated breath ($P_{ES\ start}$) and the sensitivity of the ventilator's demand system. The sensitivity of the ventilator's demand system is the difference between the baseline airway pressure (PEEP_{AW}) and the airway pressure when the patient initiates a breath ($P_{AW\ start}$). Requires an esophageal balloon.	0 to 50 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater
Ptp Plat	Transpulmonary pressure during an inspiratory hold, which is the difference between the airway plateau pressure ($P_{PLAT\ AW}$) and the corresponding esophageal pressure. Requires an inspiratory hold and esophageal balloon.	–60 to 120 cmH_2O	± 2 cm H_2O or ± 5% whichever is greater
P_{tp} PEEP	The difference between the corresponding airway and esophageal pressures at the end of the expiratory hold during an AutoPEEP maneuver. Requires an inspiratory hold and esophageal catheter.	–60 to 120 cmH_2O	± 2 cmH_2O or ± 5%, whichever is greater
MIP	The maximum negative airway pressure that is achieved by the patient, during an expiratory hold maneuver.	–60 to 120 cmH_2O	± 2 cmH_2O or ± 5%, whichever is greater
P_{100}	The negative pressure that occurs 100 ms after an inspiratory effort has been detected.	–60 to 120 cmH_2O	± 2 cmH_2O or ± 5%, whichever is greater

DISPLAY	DESCRIPTION	RANGE	ACCURACY
WOB_V	The summation of airway pressure (P_{AW}) minus the baseline airway pressure ($PEEP_{AW}$) times the change in tidal volume to the patient (ΔV) during inspiration, and normalized to the total inspiratory tidal volume (V_{ti}).	0.00 to 20.00 Joules/L	± 10%
WOB_P	Patient Work of Breathing (WOB_P), normalized to the total inspiratory tidal volume. Patient work of breathing is defined as the summation of two work components: work of the lung and work of the chest wall. Requires an esophageal balloon.	0.00 to 20.00 Joules/L	± 10%
WOB_I	The work performed by the patient to breathe spontaneously through the breathing apparatus, i.e. the E.T. tube, the breathing circuit, and the demand flow system. Requires a tracheal catheter.	0.00 to 20.00 Joules/L	± 10%

Note

Monitored values are displayed as BTPS

Sensor Specifications & Circuit Resistance

Table E.1 Varflex® Flow Sensor

Sensor	Infant 15 mm	Adult 15 mm
Part Number	7002500	7002300
Type	Single Use	Single Use
Circuit Location	Wye	Wye
Performance Specifications		
Flow Range	0.024 to 30 L/min	1.2 to 180 L/min
Diff Pres Range	± 5.72 cmH2O	± 5.72 cmH2O
Accuracy*	± (0.012 L/min + 5% or reading	± (0.1 L/min + 5% or reading
Resistance	4.5 cmH2O @ 30 L/min	2.4 cmH2O @ 60 L/min
Dead Space	0.7 ml installed	9.6 ml installed
Freq. Response**	17 Hz	26 Hz
Airway Pres Range	-140 to 140 cmH2O	-140 to 140 cmH2O
Calibration (EEPROM)	29 Point Curve	29 Point Curve
Linearity	< 1% between points	< 1% between points
Operating Temperature	5° to 40° C 41° to 104° F	5° to 40° C 41° to 104° F
Physical Specifications		
Sensor Length	1.36 in (3.5 cm)	2.45 in (6.2 cm)
Diameter Insp (Vent Side)	15 mm OD	15 mm OD
Diameter Exp (Patient)	15 mm OD	15 mm OD
Tube Length	48 in (121.9 cm)	73 in (185.4 cm)
Connector	Bicore Proprietary	Bicore Proprietary
Weight	22 g (0.7 oz)	31 g (1.0 oz)
Service Life	Single Patient Use	Single Patient Use
Sterilization	NA	NA
Material	Sensor – Lexan Flap – Mylar Tubing – PVC Connector - ABS	Sensor – Lexan Flap – Mylar Tubing – PVC Connector - ABS

L/min: Dry air at 77° F (25° C) and 14.7 psig barometric pressure.

* Includes ± 1% for linearity & hysteresis with no zero drift for the pressure transducer and ± 2 % for temperature and humidity variations.

The sensor must be corrected for barometric pressure, and oxygen concentration.

** Frequency Response is signal attenuation to 0.707 input and assumes 100 Hz sample rate.

Hot Wire Flow Sensor Specifications

Table E-2 Hot Wire Flow Sensor

Part Number	51000-40081
Type:	Multiple use heated wire
Circuit Location:	Wye
Performance Specifications	
Flow Range:	0 (+/- 0.002) to 30 L/min
Vol. Accuracy:	+/-10%
Flow Resistance:	15 cmH2O @ 20 L/min
Dead Space:	0.8 mL
Freq. Response*:	16 Hz
Calibration:	36 point curve
Linearity:	< 2%
Operating Temperature:	5 to 40°C
Physical Specifications	
Sensor length	1.68”
Diameter Insp (Vent Side)	15 mm OD
Diameter Exp (Patient Side)	15 mm OD
Tube length	N/A
Connector	Pin & Socket type
Weight	< 10g (not including wire)
Service Life	25 cycles
Sterilization	Steam Autoclave
Materials	Sensor - Delrin Wire – Platinum Screen – Stainless Steel 304 or 316 Pin – PhBz, gold over nickel plated Spacer - Delrin

Circuit Resistance (per EN794 –1)

It is important to check the inspiratory and expiratory resistance specification of patient circuits used with the AVEA to ensure they do not exceed the following limits when adding attachments or other components or subassemblies to the breathing circuit.

NOTE

Refer to product labeling supplied with any accessory to be added to the breathing circuit for this information.

- 0.6 KPA (6cmH_2O) at 60 L/min for adult patients
- 0.6 KPA (6cmH_2O) at 30 L/min for pediatric patients
- 0.6 KPA (6cmH_2O) at 5 L/min for neonatal patients

WARNING

Total resistance of the inspiratory and expiratory limbs of the breathing circuit with accessories should not exceed 4cmH_2O at 5 L/min if inspiratory flows $\geq$ 15 liters per minute are used in TCPL ventilation modes.

Circuit Resistance Test

To measure the resistance of the inspiratory and expiratory limbs of the breathing circuit with accessories connect the patient breathing circuit as described in Chapter 2.

1. Select TCPL SIMV with settings:

Rate	1
Inspiratory Pressure	15 cmH_2O
Peak Flow	8.0 L/min
Inspiratory Time	0.35 sec
PEEP	0 cmH_2O
Flow Trigger	20 Lmin
% O_2	21 %
Bias Flow	5 L/min
Pressure trigger	20 cmH_2O

2. Select waveform Pinsp

   With the patient wye blocked, allow the baseline pressure (PEEP) to stabilize for 10 seconds and press the FREEZE key.

   Use the data dial to read the pressure from the Pinsp waveform. The pressure must not exceed 4cmH2O at 5 L/min if inspiratory flows > 15 liters per minute are used in TCPL ventilation modes.

Advanced Pulmonary Mechanics Monitored Parameters

Rapid Shallow Breathing Index (f / V_t)

The ventilator is capable of displaying the calculated value for Rapid Shallow Breathing Index (f / V_t), which is the spontaneous breath rate per tidal volume, and is based on the following formula:

$f / V_t = f^2 / V_e$, where f = spontaneous breath rate (BPM) and

Ve = spontaneous minute ventilation in LPM

Range: 0 to 500 b^2/min/L

Resolution: 1 b^2/min/L

Chest wall Compliance (C_{CW})

Chest wall Compliance (C_{CW}), is the ratio of the tidal volume (exhaled) to the Delta Esophageal Pressure (dP_{ES}).

$$C_{CW} = \frac{V\text{te}}{dP_{ES}}$$

Range: 0 to 300 mL/cmH_2O

Resolution: 1 mL/cmH_2O

Note: Requires an esophageal balloon catheter.

Accuracy: ± 10%

Lung Compliance (C_{LUNG})

Lung Compliance (C_{LUNG}), is the ratio of the tidal volume (exhaled) to the delta transpulmonary pressure. The delta transpulmonary pressure is the difference between the airway plateau pressure (during an inspiratory pause) and esophageal pressure (at the time the airway plateau pressure is measured) minus the difference between the airway and esophageal baseline pressures.

$$C_{LUNG} = \frac{V\text{te}}{dP_{PLAT\ TP}}\text{, where } dP_{PLAT\ TP} = (P_{PLAT\ AW} - P_{ES}) - (PEEP_{AW} - PEEP_{ES})$$

Range: 0 to 300 mL/cmH_2O

Resolution: 1 mL/cmH_2O

Note: Requires an Inspiratory Hold maneuver and an esophageal balloon catheter.

Accuracy: ±10%

Compliance Ratio (C_{20} / C)

Compliance Ratio (C_{20} / C), is the ratio of the dynamic compliance during the last 20% of inspiration (C_{20}) to the total dynamic compliance (C).

Range: 0.00 to 5.00

Resolution: 0.01

Accuracy: ± 10%

Respiratory System Resistance (R_{RS})

Respiratory System Resistance (R_{RS}), is the total resistance during the inspiratory phase of a breath. Respiratory System Resistance is the ratio of the airway pressure differential (peak – plateau) to the inspiratory flow 12 ms prior to the end of inspiration.

Range: 0 to 100 $cmH_2O/L/sec$

Resolution: 0.1 $cmH_2O/L/sec$

Limitation: Active for volume breaths only.

Note: Requires an Inspiratory Hold maneuver.

Accuracy: ± 10%

Peak Expiratory Resistance (R_{PEAK})

The ventilator shall be capable of calculating and displaying the Peak Expiratory Resistance (R_{PEAK}), which is defined as the resistance at the time of the Peak Expiratory Flow (PEFR).

$$R_{PEAK} = \frac{P_{PEFR}}{PEFR}$$

Range: 0.0 to 100.0 $cmH_2O/L/sec$

Resolution: 0.1 $cmH_2O/L/sec$

Accuracy: ± 10%

Imposed Resistance (R_{IMP})

Imposed Resistance (R_{IMP}), is the airway resistance between the wye of the patient circuit and the tracheal sensor.

Range: 0.0 to 100.0 $cmH_2O/L/sec$

Resolution: 0.1 $cmH_2O/L/sec$

Note: Requires an Inspiratory Hold maneuver and a tracheal catheter.

Accuracy: ± 10%

Lung Resistance (R_{LUNG})

Lung Resistance (R_{LUNG}), is the ratio of the tracheal pressure differential (peak – plateau) to the inspiratory flow 12 ms prior to the end of inspiration.

Range: 0.0 to 100.0 cmH_2O/L/sec

Resolution: 0.1 cmH_2O/L/sec

Note: Requires an Inspiratory Hold maneuver and a tracheal catheter.

Accuracy: ± 10%

Peak Inspiratory Flow Rate (PIFR)

The ventilator is capable of monitoring and displaying the actual peak inspiratory flow rate for the inspiratory phase of a breath.

Range:	0 to 300 LPM	(All patients)
Resolution:	1 LPM	(Adult/Pediatric)
	0.1 LPM	(Neonate)
Accuracy:	± 10%	

Peak Expiratory Flow Rate (PEFR)

The ventilator is capable of monitoring and displaying the actual peak expiratory flow rate for the expiratory phase of a breath.

Range:	0 to 300 LPM	(All patients)
Resolution:	1 LPM	(Adult/Pediatric)
	0.1 LPM	(Neonate)
Accuracy:	± 10%	

Delta Airway Pressure (dP_{AW})

Delta Airway Pressure (dP_{AW}), which is the difference between peak airway pressure ($P_{PEAK\ AW}$) and baseline airway pressure ($PEEP_{AW}$).

$dP_{AW} = P_{PEAK\ AW} - PEEP_{AW}$

Range: –120 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Delta Esophageal Pressure (dP_{ES})

Delta Esophageal Pressure (dP_{ES}), is the difference between peak esophageal pressure ($P_{PEAK\ ES}$) and baseline esophageal pressure ($PEEP_{ES}$).

$dP_{ES} = P_{PEAK\ ES} - PEEP_{ES}$

Range: –120 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

AutoPEEP$_{AW}$

AutoPEEPaw, is the airway pressure at the end of an expiratory hold maneuver.

Range: 0 to 50 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Note

Requires a passive patient.

Delta AutoPEEP$_{AW}$ (dAutoPEEP$_{AW}$)

Delta AutoPEEP$_{AW}$ (dAutoPEEP$_{AW}$), is the difference between airway pressure at the end of an expiratory hold maneuver and the airway pressure at the start of the next scheduled breath after the expiratory hold maneuver.

Range: 0 to 50 cmH_2O

Resolution: 1 cmH_2O

Note: Requires a passive patient.

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

AutoPEEP$_{ES}$

AutoPEEP$_{ES}$ is defined as the difference between esophageal pressure measured at the end of exhalation (PEEP$_{ES}$) minus the esophageal pressure measured at the start of a patient-initiated breath ($P_{ES\ start}$) and the sensitivity of the ventilator's demand system. The sensitivity of the ventilator's demand system is the difference between the baseline airway pressure (PEEP$_{AW}$) and the airway pressure when the patient initiates a breath ($P_{AW\ start}$).

$\text{AutoPEEP}_{ES} = (\text{PEEP}_{ES} - P_{ES\ start}) - (\text{PEEP}_{AW} - P_{AW\ start})$

Range: 0 to 50 cmH_2O

Resolution: 1 cmH_2O

Note: Requires an esophageal balloon catheter.

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Transpulmonary Pressure, Plateau (P_{tp} Plat)

The ventilator is capable of calculating and displaying the Transpulmonary pressure during an inspiratory hold, which is the difference between the airway plateau pressure ($P_{PLAT\ AW}$) and the corresponding esophageal pressure.

$P_{tp}\text{Plat} = P_{PLAT\ AW} - P_{ES}$

Range: –60 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Note

Requires an inspiratory hold and an esophageal catheter.

Transpulmonary Pressure, AutoPEEP (P_{tp} PEEP)

Transpulmonary pressure, AutoPEEP (P_{tp}PEEP) is the difference between the corresponding airway and esophageal pressures at the end of the expiratory hold during an AutoPEEP maneuver.

$P_{tp}PEEP = P_{AW} – P_{ES}$ (at the end of an expiratory hold)

Range: –60 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2 cmH_2O or ± 5%, whichever is greater

Note: Requires an inspiratory hold and an esophageal catheter.

Maximum Inspiratory Pressure (MIP)

Maximum Inspiratory Pressure (MIP), is the maximum negative airway pressure that is achieved by the patient, during an expiratory hold maneuver.

Range: –60 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Respiratory Drive (P_{100})

Respiratory Drive (P_{100}), is the negative pressure that occurs 100 ms after an inspiratory effort has been detected.

$P_{100} = P_{end\ 100} – PEEP_{AW}$

Range: –60 to 120 cmH_2O

Resolution: 1 cmH_2O

Accuracy: ± 2cmH20 or ± 5%, whichever is greater

Ventilator Work of Breathing (WOB_V)

Ventilator Work of Breathing (WOB_V), is defined as the summation of airway pressure (P_{AW}) minus the baseline airway pressure ($PEEP_{AW}$) times the change in tidal volume to the patient (ΔV) during inspiration, and normalized to the total inspiratory tidal volume (V_{ti}).

If $P_{AW} > PEEP_{AW}$,

$$WOB_V = \frac{\sum_{Insp} (P_{AW} - PEEP_{AW})\Delta V}{V_{ti}}$$

Range: 0.00 to 20.00 Joules/L

Resolution: 0.01 Joules/L

Accuracy: ± 10%

Patient Work of Breathing (WOB_P) (Normalized to Delivered Tidal Volume)

Patient Work of Breathing (WOB_P), normalized to the total inspiratory tidal volume. Patient work of breathing is defined as the summation of two work components: work of the lung and work of the chest wall.

$$WOB_P = WOB_{LUNG} + WOB_{CW}$$

$$\text{where} \quad WOB_{LUNG} = \sum_{Testart}^{Tiend} (PEEP_{ES} - P_{ES})\Delta V \qquad (\text{if } PEEP_{ES} > P_{ES} \text{ and } V > 0)$$

$$\text{and} \quad WOBCW = \frac{V_P^{\,2}}{2C_{CW}} \quad (\text{if } PEEP_{ES} > P_{ES})$$

Work of the lung (WOB_{LUNG}) is calculated using esophageal pressure when the baseline esophageal pressure ($PEEP_{ES}$) is greater than the esophageal pressure (P_{ES}), indicating patient effort.

Work of the chest wall (WOB_{CW}) for a spontaneously breathing patient is calculated using only the portion of the total tidal volume delivered due to a patient effort (V_P) and the chest wall compliance (C_{CW}).

Range: 0.00 to 20.00 Joules/L

Resolution: 0.01 Joules/L

Accuracy: ± 10%

Note

Requires an esophageal balloon catheter.

Imposed Work of Breathing (WOB_I)

Imposed Work of Breathing (WOB_I), is defined as the work performed by the patient to breathe spontaneously through the breathing apparatus, i.e. the E.T. tube, the breathing circuit, and the demand flow system.

Imposed work is assessed by integrating the change in tracheal pressure and tidal volume, and normalizing the integrated value to the total inspiratory tidal volume (V_{ti}). (Requires the use of an optional tracheal catheter.) Based on the following formula:

$$WOBI = \int_0^{V_{ti}} \left(PEEP_{AW} - P_{TR}\right) * \frac{dV}{dt},$$

where $PEEP_{AW}$ = airway baseline pressure

P_{TR} = tracheal pressure

V_{ti} = inspired tidal volume

Range:	0.00 to 20.00 Joules/L
Resolution:	0.01 Joules/L
Accuracy:	± 10%

Note

Requires a tracheal catheter.

Glossary

Breath Interval	Elapsed time from the start of one breath to the start of the next.
Preset	An operator set ventilator parameter.
Trigger	Value at which the ventilator initiates delivery of a breath as a result of measured patient effort.
BTPS	Body Temperature at Ambient Pressure, Saturated.
ATPD	Ambient Temperature, Ambient Pressure, Dry.
Demand Flow	The flow generated by the ventilator to meet the patient's flow demand in order to maintain PEEP at the preset level.
DVM	Digital Volt Meter
PEEP	Positive End Expiratory Pressure.
AC	Alternating Current (mains electricity).
Bias Flow	A continuous flow through the patient breathing circuit. The level of Bias Flow can be set from .4 to 5 L/min
Bpm	Breaths per minute.
Breath Period	The length of time between machine-initiated breaths. Depends on the Breath Rate setting and is computed by dividing 60 seconds by the Breath Rate setting. When the Breath Rate setting is 15 bpm, for example, the breath period is four seconds (i.e., 60 / 15). In this example, the ventilator initiates a breath every four seconds.
Breath Rate	The number of breaths delivered in a minute.
BTPD	Body Temperature at Ambient Pressure, Dry
Button	A push button switch used to toggle a function on or off.
cmH2O	Centimeters of water pressure.
Controls	Any button, switch, or knob that allows you to modify the ventilator's behavior.
Event	An anomalous condition that occurs during ventilator operation.
Flow	The rate at which gas is delivered. Measured in liters per minute (L/min).
Indicators	A visual element showing operational status.
L	Liters. A unit of volume.
LED	Light Emitting Diode
L/min	Liters per minute. A unit of flow.
Mode	An operating state of the ventilator that determines the allowable breath types.
Monitored Parameter	A measured value displayed in the monitor window.
O2	Oxygen

Patient Breathing Circuit	The tubing that provides the ventilatory interface between the patient and ventilator.
Paw	Airway Pressure. Measured in cmH2O at the exhalation valve.
PEEP	See Positive End Expiratory Pressure.
PIP	Peak Inspiratory Pressure . Shows the highest circuit pressure to occur during inspiration as measured at the exhalation valve. The display is updated at the end of inspiration. PIP is not updated for spontaneous breaths.
Pplat	Plateau Pressure. Measured during an Inspiratory Hold maneuver. Used to calculate Static Compliance. (Cst).
PSIG	Pounds per square inch gauge. 1 PSIG = .07bar
Sigh Breath	A Volume Controlled machine breath having a tidal volume equal to one-and-a-half times (150%) of the current tidal volume setting.
User Verification Tests (UVT)	A group of tests to check ventilator performance prior to connecting the ventilator to a patient.
WOB	Patient Work of Breathing i.e. a measure of Patient Effort.

Index

A

accumulator · 2-11, 4-31
air inlet fitting · 2-9
air inlet pressure · A-70
alarm
  vent inop · 9-2
alarm speaker · 4-28
annual service · 8-1

B

back light inverter · 2-7
bias flow · A-85
breath rate · A-70
breath types · A-85

C

cautions · 1-3
compressor filters · 8-4
compressor system · 2-13
contacting the manufacturer · A-1
control PCB · 2-7
customer service · A-1

D

DC voltage · 9-1
DRAM · 2-7
drawings and schematics · A-2
driver transition board · 4-27
dynamic compliance · A-71

E

enhanced patient monitoring PCB · 2-13
error log · 9-2
exhalation valve assembly · 8-5
exhalation valve body · 8-6
exhalation valve membrane · 8-5
exhaled tidal volume · A-69
  adjusted for ideal body weight · A-69
expiratory Time · A-70
external 17 Ah lead acid batteries · 2-9

F

fan · 2-12
flash memory · 2-7
flow control system · 2-11
flow sensor · 8-7
fuses · 4-12

G

gas delivery engine · 2-10
  block diagram · 2-10

H

heated expiratory system · 2-12
Heliox connection · 3-30
heliox delivery · 3-26, 3-27
hour meter · 2-12

I

inhaled tidal volume · A-69
  adjusted for ideal body weight · A-69
inlet system · 2-10
inspiratory time · A-70
Inspiratory/Expiratory ratio · A-70
internal NiMH batteries · 2-8

L

LCD · 2-6
LED · 2-6
liquid crystal display · 2-6

M

mandatory tidal volume · A-69
  adjusted for patient weight · A-69
mean inspiratory pressure · A-70
membrane panel · 2-6
minute volume · A-70
  adjusted for patient weight · A-70
monitor CPU · 2-7

N

nebulizer system · 2-13

O

operational verification test · 9-1

optical encoder · 2-7
ordering parts · A-1
oxygen blender · 2-11
oxygen inlet pressure · A-70
oxygen sensor
  cable · 3-30
  cell · 3-30

P

parts replaced annually · 8-1
patient effort · A-85
peak Expiratory flow rate · A-71
peak Inspiratory flow rate · A-71
peak inspiratory pressure · A-70
PEEP · A-70, A-85, A-86
percent leakage · A-69
percentage of oxygen · A-71
plateau pressure · A-70
pneumatics module · 2-8
positive end expiratory pressure · A-70
power supply specifications · 4-21
power supply system · 2-9
power-on problems · 9-1
pressure transducers · 2-9

R

rapid shallow breathing index · A-70
rear panel · 8-2
removal & installation
  accumulator · 4-31
  compressor · 4-15
  driver transition board · 4-27
  EPM board · 4-16
  exhalation valve & flow sensor · 4-22
  fan assembly · 4-18
  internal batteries · 4-10
  top cover micorswitch · 4-25
  wheeled base · 4-10
replace gas inlet filters · 8-2
replace O2 filter · 8-2
replaceable fuses · 4-11
respiratory system resistance · A-71
routine maintenance
  parts replaced annually · 8-1

S

safety information · 1-1
safety-over pressure system · 2-11
service calls · A-1
specifications
  accessories · A-62
  atmospheric & environmental · A-61
  data input & output · A-56
  electrical · A-55
  physical dimensions · A-62
  pneumatic · A-55
  powersupply · 4-21
spontaneous breath rate · A-70
spontaneous minute volume · A-70
  adjusted for patient weight · A-70
spontaneous tidal volume · A-69
  adjusted for ideal body weight · A-69
static compliance · A-71
symbols · 1-4

T

TCA PCB · 2-9
theory of operation
  detail design · 2-5
  general · 2-1
  high level design · 2-3
tools & equipment · 4-1, 4-32
touch screen · 2-6
transducer calibration
  air inlet pressure · 7-16
  blended gas pressure · 7-17
  expiratory flow · 7-14
  expiratory pressure · 7-11
  O2 inlet pressure · 7-15
transformer · 9-1
troubleshooting · 9-1

V

vent inop · 9-1
vent inop alarm · 9-2
ventilator specifications · A-55

W

warnings · 1-1